FACULTY OF ENGINEERING

IASE University

Gandhi Vidya Mandir, Sardarshahr (Raj.) – 331401

Teaching and Examination Scheme and Syllabus

For

BACHELOR OF TECHNOLOGY
(BIOTECHNOLOGY)
(Four-Year Full Time Degree Programme)
(Semester Scheme)

For the Sessions 2009-10 and 2012-13

Rules and Guidelines for the students

1. BACHELOR OF TECHNOLOGY (BIOTECHNOLOGY)
Course is a Four -Year (8 Semester) Full Time Integrated Degree Programme

2. ELIGIBILITY FOR ADMISSION:
A candidate seeking admission to the first year of the **B.Tech. (Biotechnology)** course shall be required to have passed 10+2 examination with physics, Chemistry, and Mathematics or Biology from any recognized Board with at least 45% marks in aggregate for general category candidates, 40% for SC/ST/OBC candidates.

3. ADMISSION PROCEDURE:
Admission to the first year **B.Tech. (Biotechnology)** course shall be made on the basis of marks scored by the candidates in his/her 10+2 examination.

4. THE PROGRAMME
The **Bachelor of Technology (Biotechnology)** is a four year full-time intergraded degree programme. The course structure and programme administration are as follows:

A) COURSE STRUCTURE
The programme has been organized in Four years, each year comprising of two semesters. Teaching consists of Theory (Lectures and Tutorials) and Practicals / Sessional (Laboratory work, Engineering Graphics, workshop practice and project etc.)Examination will be held at the end of the each semester. Details of these are given in the teaching & examination scheme.

B) PROGRAMME ADMINISTRATION

1. PROGRAMME ADMINISTRATION

1.1. MEDIUM OF INSTRUCTION

English shall be the medium of instruction and examination.

1.2. EVALUATION

a. Each theory paper will be evaluated through a theory paper at the end of the semester carrying 100 marks along with continuous evaluation of sessional work, carrying 50 marks. The theory paper shall be of three hour duration. The sessional work will consist of continuous assessment of student's performance by teachers in tutorial classes and class tests.

b. Three class tests will be organised in each semester as per scheme. The higher two out of the marks scored in the three tests will be considered for the sessional marks.

c. Evaluation of laboratory/practical work will be through continuous assessment throughout the semester as well as examination at the end of the semester.

d. At the end of the sixth semester students will undergo practical training for a period of at Least 45 working days in an industry / research organization related to his / her field of Study. At the end of the training, the student will submit its report to the Head of the Department within two weeks of the start of the seventh semester. The report should not be less than 75 typed pages. The work of the practical training will be evaluated by a board of the two teachers appointed by the Head of the Department. The later will counter sign the marks.

e. The scheme of evaluation of project studies shall be as follows: The project work will be spread in the seventh and eight semesters. The topic of the project will be approved by the Head of the Department and the entire project work will be carried out under the guidance of a department project supervisor approved by the Head of the Department. The nature of the project work will consist of varying proportions of designing, fabrication, testing and Analysis of results. The project topic can also be taken from a live industrial problem. The Report of the completed project shall be signed by the guide and submitted to the Head of The Department on or before the last working day of the eighth semester. The evaluation of the project will be done by a board consisting of an internal and an external examiner.

2. PROMOTION AND SPAN PERIOD

2.1. The maximum span period of the programme is eight years from the date of registration in the programme.

2.2. The minimum marks for passing the examination for each semester shall be 50% in each sessional, 40% in End Semester Examination of each theory paper, 50% in each project and 45% in aggregate of all the courses (Subject, sessional and project) of the semester.

2.3. The Course of Special Mathematics (BI/BT 100) is compulsory for student's having been admitted after passing (10+2) exam with Biology subject & the course of Language Lab (BI/BT 400) is also compulsory, Students have to pass these courses before they are admitted to the 7^{th} semester .However; the marks obtained in these will not be counted for deciding the division of the student.

2.4. A student will be permitted to attend the classes of the second/fourth/sixth/eight semesters immediately after the examination of the first/third/fifth/seventh semester's examination, as the case may be, provided he/she has appeared in the first/third/fifth/seventh semester examination respectively.

2.5. To be eligible for promotion to the 3^{rd} semester of the program a student must have successfully cleared at least 11 papers out of the 22 papers including practicals / sessionals of the first and second semesters taken together, excluding the compulsory paper.

2.6. To be eligible for promotion to the 5th semester of the program a student must have successfully cleared at least 11 papers out of the 22 papers including practicals/ sessionals of the third and fourth semesters taken together.

2.7. To be eligible for promotion to the 7th semester of the program a student must have successfully cleared at least 10 papers out of the 21 papers including practicals / sessionals of the fifth and Sixth semesters taken together.

2.8. A student promoted to the third/fifth/Seventh semesters, without having cleared all the papers, will have to appear and pass the backlog papers of the first/third/fifth semesters along with the regular examinations of the first/third/fifth semesters and the backlog papers of the second/fourth semesters along with the regular examination of the second/fourth /sixth semesters. For this purpose syllabus prevailing at the time of examination will be applicable.

2.9. A candidate who has secured minimum marks to pass in each paper but has not secured the minimum marks required to pass in the aggregate for the semester concerned may take re-examination in not more than two theory papers to obtain the aggregate percentage required to pass the semester. The candidate will have to pay the requisite examination fee in order to be eligible for re-examination. In this case the marks secured by the candidate in the earlier examination in the paper concerned will be treated as **cancelled**. For this purpose syllabus prevailing at the time of examination will be applicable.

2.10. (a) Award of Division:

- Securing 60% marks and above – 1st division
- Securing 50% and above but below 60% - 2nd division
- Securing 45% and above but below 50% – Pass

(b) For the declaration of Final B.Tech result, marks shall be totalled up as follows:

- First B.Tech: 50% of the Marks secured
- Second B.Tech: 75% of the Marks secured
- Third B.Tech: 100% of the Marks secured
- Final B.Tech: 100% of the Marks secured
- For first B.Tech to third B.Tech the division will be decided based on the marks obtained in the respective class/ year
- A student who has secured 75% marks and above shall be declared to have passed in first division with honours. However, for this the student must have cleared successfully the entire Subject in **single attempt** with in the final year period of his/her study.
- Similarly to be eligible for a gold medal on account of having secured first position, the student must have cleared all papers in **single attempt** and passed with first division

2.11. For determining merit position of the candidates at the finial year level the marks obtained by then in the second, third final years as described above shall only be considered.

2.12. If a student (who has successfully completed the programme) wishes to reappear in one or more theory papers of the first, second, third, fourth, fifth, sixth, seventh or eighth semesters for the purpose of **improving** his/her **marks**, he/she will be permitted to do so on payment of requisite examination fee along with the regular examinations of that semester; however, the total number of such attempts shall not exceed **four** theory papers during the span period of the programme. For this his/her previous performance in the paper/papers concerned will be treated as **cancelled**. The application for such reappearing/re-examination must be submitted before the next examination of the corresponding semester. However, such candidates shall not be considered for award of gold medal.

2.13. A student to be eligible for award of **degree** has to **clear all papers** offered during four-year programme within the **span period** of eight years.

5. LATERAL ENTRY

a) Candidates having passed B.Sc with 60 % marks can be admitted to 3rd semester of B.Tech programme. However they shall be required to study and pass the following courses between the regular examinations of third to eighth semesters.

For students with Mathematics in B.Sc:

BI/BT 105-Manufacturing Process
BI/BT 106-Electrical Engineering I
BI/BT 110-Engineering Graphics I
BI/BT 111-Workshop Technology
BI/BT 202-Electrical Engineering II
BI/BT 204-Fundamental of Biotechnology
BI/BT 206-Electronics
BI/BT 210-Engineering Graphics II

For students with Biology in B.Sc:

BI/BT 100-Special Mathematics*
BI/BT 101- Mathematics I
BI/BT 105-Manufacturing Process
BI/BT 106-Electrical Engineering I
BI/BT 110-Engineering Graphics I
BI/BT 111-Workshop Technology
BI/BT 201- Mathematics II
BI/BT 202-Electrical Engineering II
BI/BT 206-Electronics
BI/BT 210-Engineering Graphics II
*the rule of the passing this Paper will remain the same as give in Point 4(B) 2.3 above

b) No candidate of this category shall be permitted for regular course of study in Final B.Tech unless he/she has passed the papers as mention above.

6. ATTENDANCE

All students are required to have 75% attendance in each subject and there must be 75% attendance of the student before he/she could be permitted to appear in the examination.

7. RULES FOR THE AWARD OF GRACE MARKS

UNDER GRADUATE/ POST GRADUATE (MAIN/SUPPLYMENTARY EXAMINATIONS UNDER THE FACULTIES OF ENGINEERING & TECHNOLOGY.

Grace marks to the extent of 1% of the aggregate marks prescribed for an examination will be awarded to a candidate failing in not more than 25% of the total number of theory papers, practicals, sessionals, dissertation, viva-voce and the aggregate, as the case may be in which minimum pass marks have been prescribed; provided the candidate passes the examination by the award of such Grace marks. For the purpose of determining the number of 25% of the papers, only such theory papers practicals, dissertation, viva-voce etc. would be considered, of which, the examination is conducted by the University.

N.B.:- If 1% of the aggregate marks or 25% of the papers works out in fraction, the same will be raised to the next whole number. For example, if the aggregate marks prescribed for the examination are 450, grace marks to the extent of 5 will be awarded to the candidate, similarly, if 25% of the total papers is 3.2, the same will be raised to 4 papers which grace marks can be given.

GENERAL:-

- A candidate passes in a paper/ practical or the aggregate by the award of grace marks will be deemed to have obtained the necessary minimum for a pass in that paper/ practical or in the aggregate and shown in the marks sheet to have passed by grace. Grace marks will not be added to the marks obtained by a candidate from the examiners nor will the marks obtained by the candidate be subject to any deduction due to award of grace marks in any other paper/ practical or aggregate.
- If a candidate passes the examination but misses First or Second Division by one mark, his aggregate will be raised by one mark so as to entitle him for the first or second division, as the case may be. This one mark will be added to the paper in which he gets the least marks and also in the aggregate by showing +1 in the tabulation register below the marks actually obtained by the candidate. The marks entered in the marks-sheet will be inclusive of one grace mark and it will not be shown separately.
- Non appearance of a candidate in any paper will make him ineligible for grace marks. The place of a passed candidate in the examination list will, however be determined by the aggregate marks he secures from the examiners, and he will not, by the award of grace marks, become entitled to a higher division.
- Distinction won in any subject at the examination is not to be forfeited on the score that a candidate has secured grace to pass the examination.

Note: - The Grace marks will be awarded only, if candidate appears in all the papers prescribed for the examination.

8. Rules for change of branch for the students of III Sem. B.Tech/ B.E.:

I The faculty, on the basis of applications received from desirous students up to the date and time notified by the Director, will prepare a merit list of the students. The list will be prepared on the basis of overall merit of the 1st (Semester) result only and the applications for change of branch will be processed as per the merit list.

II Request for change from B.E. to B. Tech. programme or vice versa by any student will be considered only if, the candidate fulfils basic admission criteria for the desired programme and using the guidelines below:

If the candidate is eligible for change from B. Tech. to B.E. & vice-versa is found deficit in the course coverage of first and second semester, he will have to pass the deficit courses before the candidate is admitted to the seventh semester. However, the marks obtained in the deficit courses will not be added for deciding the division of the student.

ELIGIBILITY CRITERIA:

(a) The students must have passed the 1st Semester B.Tech./B.E Examination in all components in one attempt with at least 60% marks in aggregate. The student with back papers or whose result has not been declared will not be considered for change of branch.

(b) In case any student has applied for re-valuation/re-totalling of his/her marks of 1st Semester B.Tech/B.E and the result has not been received till the time of change of branch, such a student will not be entitled for change of branch on the basis of his/her subsequently revised result.

PROCEDURE:

1) Applications in a specified format (developed by the faculty) for change of branch will be invited by the Director/Principal of the faculty on the basis of the result of I (Semester) B. Tech./ B.E in duplicate, up to the date notified by IASE University. One copy of each such application be sent to IASE University by that date.

2) The students would submit a photo copy of 1st (Semester) Examination mark sheet of that year along with the application. The student may give as many preferences as possible against the vacant seats in respective college.

3) A seat matrix shall be prepared by the faculty, as per the details of the vacant seats (admitted through direct admission) in the previous year.

4) Due to change of branch, the strength of student in any branch should not fall short of 75% of the enrolled students in that branch in that year. And under no circumstances, due to change of branch, the number of seats in a particular branch in a college shall exceed the sanctioned strength approved by the AICTE, for that batch.

5) All students who have applied for the change of branch in-time will be called for counselling by the admission council of the faculty and considered for change of branch as per merit, preference and availability of seat. However, at the time of the counselling, if any student wishes to withdraw his/her application he/she can do so by a written request. In case any student does not present himself/herself for counselling, his/her branch will be changed as per the preference mentioned in the application form, merit and availability of seat.

PROPOSED DRAFT OF TEACHING & EXAMINATION SCHEME
for B.Tech. (BT) – Four Year (8 Semester) Full Time Degree Programme

B.Tech. (BT) – First Year **Semester - I**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BI/BT 101	Mathematics I	3	1	-	30	20	50	100	150
2	BI/BT 102	Engineering Chemistry I	3	1	-	30	20	50	100	150
3	BI/BT 103	Engineering Physics I	3	1	-	30	20	50	100	150
4	BI/BT 104	English	2	1	-	30	20	50	100	150
5	BI/BT 105	Manufacturing Processes	2	1	-	30	20	50	100	150
6	BI/BT 106	Electrical Engineering I	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
7	BI/BT 107	Engineering Chemistry Lab	-	-	3	50	-	50	50	100
8	BI/BT 108	Engineering Physics Lab I	-	-	2	50	-	50	50	100
9	BI/BT 109	Electrical Engineering Lab I	-	-	2	50	-	50	50	100
10	BT /BI 110	Practical Geometry	-	-	3	50	-	50	50	100
11	BI/BT 111	Workshop Technology	-	-	3	50	-	50	50	100

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1400
Total Periods – 35

	BI/BT 100*	Special Mathematics	3	1	-	30	20	50	100	150

*This Course of Special Mathematics (BI/BT 100) is compulsory for student's having been admitted after passing (10+2) exam with Biology Subject. Students have to pass this course, however the marks obtained in this will not be counted for deciding the division of the student.

B.Tech. (BT) – First Year **Semester- II**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BI/BT 201	Mathematics II	3	1	-	30	20	50	100	150
2	BI/BT 202	Electrical Engineering II	3	1	-	30	20	50	100	150
3	BI/BT 203	Engineering Physics II	3	1	-	30	20	50	100	150
4	BI/BT 204	Fundamental of Biotechnology	3	1	-	30	20	50	100	150
5	BI/BT 205	Engineering Chemistry II	2	1	-	30	20	50	100	150
6	BI/BT 206	Electronics	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
7	BI/BT 207	Electrical Engineering Lab II	-	-	2/2	50	-	50	50	100
8	BI/BT 208	Engineering Physics II	-	-	2	50	-	50	50	100
9	BI/BT 209	Electronics Lab	-	-	2/2	50	-	50	50	100
10	BI/BT 210	Machine Drawing	-	-	3	50	-	50	50	100
11	BI/BT 211	Computer System and Programming	2	-	3	50	-	50	100	150
		Discipline and Extra curricular activities	-	-	-	-	-	-	-	100

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1550
Total Periods – 35

B.Tech. (BT) – Second Year **Semester- III**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BI/BT 301	Mathematics III	3	1	-	30	20	50	100	150
2	BT 302	Fluid Mechanics	3	1	-	30	20	50	100	150
3	BT 303	Thermal Science	3	1	-	30	20	50	100	150
4	BI/BT 304	Cell Biology	3	-	-	30	20	50	100	150
5	BI/BT 305	Bio molecules & Metabolism	3	1	-	30	20	50	100	150
6	BT /BI 306	Microbiology	3	-	-	30	20	50	100	150
7	BT 307	Material and Energy Balance	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
8	BT 308	Fluid Mechanics	-	-	2	50	-	50	50	100
9	BI/BT 309	Cell Biology	-	-	2/2	30	-	30	45	75
10	BI/BT 310	Bio molecules & Metabolism	-	-	2/2	50	-	50	50	100
11	BI/BT 311	Microbiology	-	-	2	50	-	50	50	100
12	BT 312	Thermal Science	-	-	2	30	-	30	45	75

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1500
Total Periods – 34

B.Tech. (BT) – Second Year **Semester- IV**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BI/BT 401	Genetics	3	1	-	30	20	50	100	150
2	BI/BT 402	Molecular Biology	3	1	-	30	20	50	100	150
3	BI/BT 403	Bio Physics	3	1	-	30	20	50	100	150
4	BI/BT 404	Instrumental Methods of Analysis	3	1	-	30	20	50	100	150
5	BT 405	Transport Phenomena	3	1	-	30	20	50	100	150
6	BI/BT 406	Technical Communication	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
7	BI/BT 407	Genetics	-	-	2	50	-	50	50	100
8	BI/BT 408	Molecular Biology	-	-	2	50	-	50	50	100
9	BI/BT 409	Bio Physics	-	-	2	50	-	50	50	100
10	BI/BT 410	Instrumental Methods of Analysis	-	-	2	50	-	50	50	100
		Discipline and Extra curriculer activities	-	-	-	-	-	-	-	100

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1400
Total Periods – 32

	BI/BT 400*	Language Lab	3	1	-	30	20	50	100	150

*This Course of Language Lab (BI/BT 400) is compulsory, Students have to pass this course, however the marks obtained in this will not be counted for deciding the division of the student.

B.Tech. (BT) –Third Year **Semester- V**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BI/BT501	Management Concepts and Practices	3	1	-	30	20	50	100	150
2	BI/BT502	Genetic Engineering	3	1	-	30	20	50	100	150
3	BI/BT503	Biochemical Engineering	3	1	-	30	20	50	100	150
4	BT 504	Microbial Technology	3	1	-	30	20	50	100	150
5	BI/BT505	Immuno Technology	3	1	-	30	20	50	100	150
6	BT 506	Bioinformatics	3	1	-	30	20	50	100	150
7	BT 507	Elective A-I	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
8	BI/BT508	Genetic Engineering	-	-	2	50	-	50	50	100
9	BT 509	Microbial Technology	-	-	2/2	50	-	50	50	100
10	BI/BT510	Immuno Technology	-	-	2/2	50	-	50	50	100
11	BT 511	Bioinformatics	-	-	2	50	-	50	50	100

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1450
Total Periods – 34

B.Tech. (BT) – Third Year **Semester- VI**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BI/BT601	Economics	3	1	-	30	20	50	100	150
2	BT 602	Plant Biotechnology	3	1	-	30	20	50	100	150
3	BT 603	Animal Biotechnology	3	1	-	30	20	50	100	150
4	BT 604	Bio Medical Instrumentation	3	1	-	30	20	50	100	150
5	BI/BT605	Environment & Disaster Management	3	1	-	30	20	50	100	150
6	BT 606	Elective B-I	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
7	BT 607	Plant Biotechnology	-	-	2	50	-	50	50	100
8	BT 608	Animal Biotechnology	-	-	2	50	-	50	50	100
9	BI/BT609	Group Discussion & Viva - Voce	-	-	2	50	-	50	50	100
10	BT 610	Bio Medical Instrumentation	-	-	2	50	-	50	50	100
		Discipline and Extra curricular activities	-	-	-	-	-	-	-	100

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1400
Total Periods – 32

B.Tech. (BT) – Fourth Year **Semester- VII**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BT 701	Environmental Biotechnology	2	1	-	30	20	50	100	150
2	BT 702	Down Stream Processes	3	1	-	30	20	50	100	150
3	BI/BT703	Bio safety , Ethics , Patenting and IPR	2	1	-	30	20	50	100	150
4	BT 704	Elective A-II	3	1	-	30	20	50	100	150
5	BT 705	Elective B-II	3	1	-	30	20	50	100	150
6	BT 706	Elective B-III	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
7	BT 707	Environmental Biotechnology	-	-	1	50	-	50	50	100
8	BT 708	Down Stream Processes	-	-	2	50	-	50	50	100
9	*BT 709	Project	-	-	4	-	-	-	-	-
10	BT 710	Practical Training	-	-	-	-	-	-	-	100

*Project will continue in 4th year (7th & 8th Semesters) but will be tabulated in the final result (8th Semester)

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 1200
Total Periods – 29

B.Tech. (BT) – Fourth Year **Semester- VIII**

S. No.	Course No.	Subject	Periods			Evaluation Scheme				
THEORY			L	T	P	SESSIONAL EXAM			ESE	TOTAL
						TA	CT	TOT		
1	BT 801	Elective A-III	3	1	-	30	20	50	100	150
2	BT 802	Elective B-IV	3	1	-	30	20	50	100	150
PRACTICALS / SESSIONALS										
3	BI/BT 803	Project	-	-	16	-	-	50	50	400
		Discipline and Extra curricular activities	-	-	-	-	-	-	-	100

TA – Teacher's Assessment
CT – Class Test
ESE – End Semester Examination

Total Marks – 800
Total Periods – 24

LIST OF ELECTIVE PAPERS

Group-A-I:
BT-A-I-1 – Bio-Diversity, Bioprospecting, Organic Farming
BT-A-I-2 – Biological Spectroscopy
BT-A-I-3 – Food Biotechnology

Group-A-II:
BT-A-II-1 – Genetically Modified Organisms
BT-A-II-2 – Genomics and Proteomics
BT-A-II-3 – Metabolic Engineering

Group-A-III:
BT-A-III-1 – Protein Engineering
BT-A-III-2 – Enzyme Engineering
BT-A-III-3 – Reaction Engineering

Group-B-I:
BT-B-I-1 – Vaccine Biotechnology
BT-B-I-2 – Drug Designing
BT-B-I-3 – Transfer Processing I

Group-B-II:
BT-B-II-1 – Biological NMR
BT-B-II-2 – Bioreactor Design & Analysis
BT-B-II-3 – Transfer Processing II
Group-B-III
BT-B-III-1 – Diagnostics
BT-B-III-2 – Bimolecular Modeling
BT-B-III-3 – Cell & Tissue Engineering

Group-B-IV
BT-B-IV-1 – Nanobiotechnology
BT-B-IV-2 – Digital Signal Processing
BT-B-IV-3 – Industrial Instrumentation

FIRST YEAR
Semester – I

BI/BT-100 – Special Mathematics*

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

*This Course of Special Mathematics (**BI/BT** 100) is compulsory for student's having been admitted after passing (10+2) exam work Biology Subject. Students have to pass this course, however the marks obtained in this will not be counted for deciding the division of the student.

Unit 1: Algebra
Factorization, Quadratic equations, Binomial theorem, Exponential and logarithmic series.

Unit 2: Trigonometry
Trigonometrically Ratio of Allied angles, Trigonometrically Ratio of Compound angles, Conditional Identities, Relation between sides and angles of a Triangle, Inverse circular functions.

Unit 3: Differential Calculus
Derivatives, Application of Derivatives, Second order derivatives.

Unit 4:.Integration Calculus
Integration as Inverse of differentiation, Integration by Substitution, Integration by Parts, Integration of Algebric function, Integration by partial Fraction method Integration of Trigonometric functions.

Unit 5:.2D Coordinate Geometry
Cartesian Coordinates, Locus, Straight Line, Pair of Straight Lines, change of axes, Circle, Elementary Parabola & Ellipse.

Reference:

1. R.D. Sharma- Mathematics- (Class 11 and 12) Dhanpat Rai Prakashan
2. R.S. Agarwal- Mathematics- (Class 11 and 12) Bharti Prakashan

BI/BT -101 – Mathematics I

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Three dimensional geometry: Quadratic surfaces : Sphere : Plain section of sphere , intersection of sphere with straight line ,tangent plain & tangent Line of sphere , Cylinder , Cone and Central Conicods (in standard forms).

Unit 2:
Addition , Subtraction and Multiplication of Matrices , rank of matrix , Inverse of a matrix , Cramer's rule , Matrix method , Cayley-Hamilton theorem , Eigen values and Eigen vectors.

Unit 3:
Limit , Continuity , Derivatives , application of derivatives , Higher order derivatives , Successive differentiation , Leibnitz theorem for nth derivative , Taylor's theorem , Tangent & Normal , Radius of curvature , Asymptotes , Tracing of Curves.

Unit 4:
DIfferentiablity of functions of two variables, Euler's theorem , Partial differentiation , Chain-rule , Jacobian , Taylor's theorem of two variables , Maxima and Minima of two functions.

Unit 5:
Methods of Integration, Indefinite Integral, Definite Integral, Gamma and Beta functions, Dirichlet's integral.

Reference:

1. B.S.Gareval - Higher Engineering Mathematics
2. Gaur&Kaul - Engineering Mathematics I
3. R.D.Sharma - Mathematics I

BI/BT -102 – Engineering Chemistry

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Solution- Molarity, Molalily, Normality, Mole Fraction, Colligative properties - Lowering in vapour Pressure, Depression in Freezing point, Elevation in Boiling point. Thermochemistry. Entropy & Free Energy, Corrosion and fuel cells.

Unit 2:
Kinetics and catalysis- 1^{st} ,2^{nd} & 3^{rd} order of reaction .Arrheneius theory and collision theory of chemical reaction. Langmuir isotherm, Freundlich isotherm, Homogeneous and Heterogeneous catalysis. Enzyme catalyzed reactions.

Unit 3:
Stereochemistry- Configuration, R,S nomenclature Geometric isomerism with special evidence of allene and cyclic system cyclopropane. E&Z nomenclature. Chirality, Optical isomerism with example of Spiro compounds.

Unit 4:
Reaction Mechanism- Reaction intermediates e.g. carbocation and carboanion involved reaction in cis and trans 2-butene. Aromatic electrophillic substitution and nucleophillic substitution.

Unit 5:
CFT and MOT of Octahedral and Tetrahedral complexes, Jhon Teller distortion (d^9 case). Organometallics - Metal carbonyls - structure and bonding, metal alkenes – complexes bonding and utility, metal ion in biological system with special reference to Cu and Fe.

Reference:

1. J. Huheey – Inorganic Chemistry
2. Jerry March – Advanced Organic Chemistry
3. Malik, Tuli & Madan – Some Selected Topics in Inorganic Chemistry
4. Atkins – Physical Chemistry
5. Puri, Sharma & Pathania – A Text Book of Physical Chemistry

BI/BT -103 – Engineering Physics I

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:40

Unit 1:
Interference:- Coherence and coherent sources, Superposition of principle, Interference by division of wave-front- Young' s double slit experiment, Fresnel Biprism, Interference by division of amplitude – Thin Film, Newton rings, Michelson Interferometer

Unit 2:
Diffraction:- Fresnel and Fraunhoffer types of diffraction, Fraunhoffer diffraction- single slit , Diffraction grating - Wavelength Determination, Resolving power and dispersive power. Rayleigh criterion ,Resolving Power of optical instruments: Microscope, Telescope , Diffraction grating

Unit 3:
Polarization:- types of polarization, Nicol prism, Double refraction, elliptically and circularly polarized light, Brewster's law, Malus law, Quarter wave and half wave plates, Optical activity, specific rotations

Unit 4:
Thermodynamics:- Thermodynamics Processes–Reversible and irreversible process, cyclic process, Isothermal and adiabatic process, First Law of Thermodynamics, Applications of First law of thermodynamics, Second law of Thermodynamics, Maxwell's Thermo dynamical Relations, Applications of Maxwell's Thermo dynamical Relations, Maxwell Boltzmann distribution, Bose Einstein and Fermi Dirac statistics

Unit 5:
Theory of relativity-Inertial frame of reference , Non-inertial frame of reference, Michelson- Morley experiment, Einstein's special Theory of Relativity Lorentz Transformation, length contraction, time dilation, variation of mass with velocity, Equivalence of mass and energy.

Reference:

1. A.K. Ghatak - Optics
2. Dr. G.D. Ladiwala - Engineering Physics
3. D.S. Mathur - Mechanics
4. Haliday & Resnik - Modern Physics
5. Engineering Physics, S. CHAND Publ.

BI/BT -104 – English I

(L: 2: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Short Stories - "The Gift of the Magi" by O. Henry; "The Fortune-Teller" by Karl Capek; "The Nightingale and the Rose" Oscar Wilde.

Unit 2:
Short Stories - "Dr. Heidegger's Experiment" by Nathaniel Hawthorne; "The Three Dancing Goats" by Anonymous; "The Accompanist" by Anita Desai.

Unit 3:
Poems - "Mending Wall" by Robert Frost; "This is Going to Hurt Just a Little Bit" by Odgen Nash; "Death and Leveler" by James Shirley; "Last Lesson of the Afternoon" by D. H. Lawrence; "Night of the Scorpion" by Nissim Ezekiel.

Unit 4:
Short Plays - "The Dear Departed" by Stanley Houghton; "Refund" by Fritz Karinthy; "Monkey's Paw" by W. W. Jacobs.

Unit 5:
Essays - "Of Studies" by Francis Bacon; "Third Thoughts" by E. V. Lucas; "Toasted English" by R. K. Narayana.

Reference:

1. Selection from English Literature , Ed. R.K .Lydia; Oxford university press.

BI/BT -105 – Manufacturing Processes

(L: 2: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Concept of engineering materials and manufacturing: Basic manufacturing processes; Casting process; tools and equipments, pattern materials, types and allowances, moulding sand; types, composition and properties, core sands and core making, casting defects, cleaning and fettling

Unit 2:
Welding fundamentals, edge preparation, Types of welded joints, gas welding process and equipments. Types of flames, Welding methods, oxyacetylene cutting, manual metal arc welding process, welding defects

Unit 3:
Hot and cold working processes: Forging operations, drop, horizontal and press forging, rolling, extrusion, wire drawing and tube drawing, tools and equipments used in the above operations, forging defects.

Unit 4:
Brief description of lathe, drilling, shaping, planning and milling machines

Unit 5:
Metal Cutting tools, Concept of metal cutting process, Grinding operation, Plane and cylindrical grinders, grinding wheels, Elementary concept of lapping and honing operation. Fitting hand tools, marking and measuring devices

Reference:

1. S.K. Hazra Choudhary – Workshop Technology – Part I ,Part II
2. B.S. Raghuvanshi – Workshop Technology – Part I , Part II
3. P.C Sharma - Manufacturing Processes
4. W.A.J Chapman – Workshop Technology , Part I, part II , Part III

BI/BT -106 – Electrical Engineering I

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit: 1
Nature of Electricity and OHM'S Law: Nature of electricity, Electric Current, Potential Difference, Potential, Resistance, Ohm's Laws, Laws of Resistance. Conductance and Conductivity. DC Circuits: series and parallel circuits, Current Distribution in Parallel circuits.

Unit: 2
D.C. Networks: Kirchoff 's Laws, Source Conversion, Voltage and Current divider Rule, Node Voltage and Mesh Current Analysis. Delta-Star and Star-Delta Transformations, Classification of Network Elements. Network Theorems-Superposition theorem, Thevenin's theorem.

Unit: 3
Measurement of electrical quantities: -Construction, Working principle, Merits and Demerits of Moving Coil and Moving iron type indicating instruments (voltage, current).
Introduction to power and energy meters.

Unit: 4
Single phase AC Circuits: Generation of Single Phase AC Voltage, EMF Equation, RMS and Average Values. Sinusoidal and phasor representation of Voltage and Current: Single phase AC circuit-behavior of resistance, inductance and capacitance and their combination in series & parallel. Resonance in series parallel circuit.

Unit: 5
Three phase A.C. Circuits: Introduction of poly phase, Advantages of three phases over the single phase. Generation of three phase AC Voltage. Star-Delta connections, line and phase Voltage/Current relations, three phase power and its measurement.

Reference:

1. B.L. Theraja. "Fundamentals of electrical Engg.and Electronics", S. Chand & Co.
2. J.B. Gupta "Fundamentals of electrical Engg. and Electronics",

FIRST YEAR
Semester – II

BI/BT 201 – Mathematics II

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Linear Differential Equations with constant coefficients , Euler-Cauchy equations , Solution of second order differential equations by change of variables Method of variation of Parameters , Equation of the form y" = f(y) and their Applications , Ordinary Differential equations.

Unit 2:
Convergence and their tests (ratio, comparison, integral, root, logarithmic , higher ratio tests and Leibnitz test (without proof) Uniform Convergence and its properties , Weiestrass M – test.

Unit 3:
Group general property of groups, order and elements of a group, Permutation even & odd Permutation, Group of Permutation, Cyclic group Sub group, Normal sub group

Unit 4:
Addition and Subtraction of vectors, Scalar and dot product, Cross product.

Unit 5:
Differentiation of vectors , Gradient , Divergence , Curl and their Physical meaning , Differential operator and their Identities , Line and Surface integrals , Green's theorem in a plane , Gauss and Stokes theorem and their applications.

Reference:

1. B.S.Grewal "Higher Engineering mathematics"
2. Gaur & Kaul "Engineering mathematics II"

BI/BT 202 – Electrical Engineering II

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Transformer: Faraday's Law of Electromagnetic Induction, Construction and principle of operation of single phase transformer, EMF Equation, Voltage and Current relationship, phasor Diagram of Ideal transformer and equivalent circuit . Efficiency and O.C. & S.C. tests.

Unit 2:
D.C. Machines: Basic Principles of electromechanical energy conversion. Construction, Types and Basic principle of operation of DC machines. E.M.F. Equation, Magnetization and load characteristics, losses, efficiency and applications. Speed control of DC motors.

Unit 3:
Three phase induction Motor: -Construction, principle of operation, types and methods of Starting, Slip-torque characteristics, applications.
Single-phase induction Motor: principle of operation, methods of Starting, applications.

Unit 4:
Three phase Synchronous Machines: Construction, Basic principle of operation and application of synchronous motor.
Magnetic Circuit: Introduction of Magnetic Circuit, Magnetic field and magnetic force, Magnetic flux and Magnetic flux density.

Unit 5:
Industrial Utilization: Industrial Drives, Selection of Electric Motor, Motor for particular Services, Electric Heating: Resistance Heating (Direct Resistance Heating, Indirect Resistance Heating, Resistance Ovens and Furnaces), Induction Heating (Core type and Coreless Induction Furnace).

Reference:

1. B.L. Theraja. "Fundamentals of electrical Engg.and Electronics", S. Chand & Co.
2. J.B. Gupta "Fundamentals of electrical Engg. and Electronics",

BI/BT 203 – Engineering Physics II

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Quantum Mechanics - Wave particle duality phase velocity and group velocity, Heisenberg's Uncertainty principle and its Application, Wave function and its interpretation Schrödinger's wave equation, Particle in One-Dimensional box; Particle in Three-Dimensional box, One-Dimension harmonic oscillator.

Unit 2:
Laser - Introduction, Tempoeral and Spatial coherence, Einstein Coefficient, Population inversion, Basic principle and operation of a laser, Type of a laser-He-Ne Laser, Ruby Laser, Semiconductor Laser,

Unit 3:
Band Theory of solids - Energy Band, Energy Gap, classification of solids, Energy band Structure-Solid, conductor, semi conductor and Insulator, Fermi Dirac function, Extrinsic and Intrinsic semiconductors. Dopping- Fermi Energy for dopped and undopped semiconducters, the P-N Junction (Energy Band diagram with Fermi Energy)

Unit 4:
Super conductivity - Introduction of Superconductivity, Meissner effect, London penetration Depth, Flux Quantization, The BCS Theory, Type –I super conductor, Type- II Super conductor and its Application, Josepheson effect.

Unit 5:
Nuclear fission and fusion - Nuclear fission- Introduction, fission Energy, Theoritical explanation of fission by liquid drop model, chain reaction –Atom bomb, Nuclear fusion – fusion process, Hydrogen bomb, source of energy of stars, Nuclear Reactor.

Reference:

1. A.K.Ghatak - Optics
2. Dr.G.D.Ladiwala - Engineering physics
3. D.S. Mathur - Mechanics
4. Ghatak and Lok Nathan - Quantum mechanics
5. Satya prakash - Quamtum mechanics
6. S.O.Pillai - Solid state physics
7. D.C. Tayal - Nuclear physics
8. S.N.Ghosal - Nuclear physics

BI/BT 204 – Fundamental of Biotechnology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to Biotechnology: Definitions, Historical perspectives, Scope and importance, Commercial potential, An interdisciplinary challenge, A Quantitative approach, Classical vs. Modern concepts, Manufacturing quality control, Product safety, Good manufacturing practices, Good laboratory practices, Marketing,
Biotechnology in India and Global trends

Unit 2:
Protein Structure and Engineering: Introduction to the world of Proteins, 3-D Shape of Proteins, Structure Function relationship in Proteins, Purification of Proteins, Characterization of Proteins, Protein based products, Designing Proteins, Proteomics.
Recombinant DNA Technology: Introduction, Tools of rDNA Technology, Making Recombinant DNA, DNA Library, Introduction of Recombinant DNA into host cells, Identification of Recombinants, Polymerase Chain Reaction (PCR), DNA Probes, Hybridization Techniques, DNA Sequencing, Site-directed mutagenesis.

Unit 3:
Genomics and Bioinformatics: Introduction, Genome Sequencing Projects, Gene prediction, SNPs, comparative genomics, Functional Genomics, Sequences and Nomenclature, Information Sources, Analysis using Bioinformatics tools.
Microbial Culture and Applications: Introduction, Microbial Culture Techniques, Measurement and Kinetics of Microbial Growth, Scale up of Microbial Process, Isolation of Microbial Products, Strain Isolation and Improvement, Applications of Microbial Culture Technology, Bioethics in Microbial Technology.

Unit 4:
Plant Cell Culture and Application: Introduction, Cell and Tissue Culture Techniques, Applications of Cell and Tissue Culture, Gene Transfer Methods in Plants, Transgenic Plants with Beneficial Traits, Diagnostics in Agriculture and Molecular Breeding, Bioethics in Plant Genetic Engineering.
Animal Cell Culture and Applications: Introduction, Animal Cell Culture Techniques, Characterization of Cell Lines, Scale-up of Animal Culture Process, Applications of Animal Cell Culture, Stem Cell Technology, Bioethics in Animal Genetic Engineering.

Unit 5:
Biotechnology and Society - Public perception, Role of sciences, Engineering,
Arts, Commerce, Patenting - Criterion for patents, Discovery vs Invention, Product and process patent, Reading a patent, National and International Patent Laws, Varietal protection, Patenting of biological systems, Ethical issues in agriculture and health care.

Reference:

1. Introduction to Biotechnology by P. K Gupta, Rastogi Publications
2. Biotechnology by Smith, Cambridge Press.

BI/BT 205 – Engineering Chemistry II

(L: 2: T: 1) **Max.Marks:100**
Min.Marks:40

Unit 1:
Thermodynamics- Thermochemistry with numerical problems related to chemical reactions and equations. Entropy & Free Energy concept, Corrosion and fuel cells.

Unit 2:
Carbohydrates- General Structure and properties of carbohydrates. Monosaccharides (Pyranose & Furanose), Oligosaccharides (Sucrose) and polysaccharides (Starch and glycogen)

Unit 3:
Surface Chemistry- Adsorption, Chemisorptions Factors influencing adsorption, Langmuir isotherm, Freundlich isotherm BET Theory of Multilayer Adsorption, colloids, surfactants, Emulsions, Applications and importance of colloids,

Unit 4:
Aromatic electrophillic substitution, nucleophillic substitution and free radical substitution reactions with suitable examples.

Unit 5:
Organometallics - Metal carbonyls - structure and bonding, metal alkenes – complexes bonding and utility, metal ion in biological system with special reference to Cu and Fe.

Reference:

1. J. Huheey – Inorganic Chemistry
2. Jerry March – Advanced Organic Chemistry
3. Malik, Tuli & Madan – Some Selected Topics in Inorganic Chemistry
4. Atkins – Physical Chemistry
5. Puri, Sharma & Pathania – A Text Book of Physical Chemistry

BI/BT 206 – Electronics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Semiconductors, Energy-Band Theory, Intrinsic and Extrinsic Semicondoctors,Fermi Level in an Extrinsic Semicondoctor,Hall effect , P-N Diode, Junction Diode, Junction Breakdown,Zener Diode

Unit 2:
Introduction of Bipolar Junction Transistor, Transistor Biasing, Working of Transistor, Configuration of Transistor : CB,CE,CC ,Current Amplification Factors, Ebers-Moll Model, Transistor as an amplifier, Hybrid Model

Unit 3:
Rectifiers, Filter Circuits, R-C coupled and Transformer coupled amplifier, Push-Pull amplifier, Feedback circuits

Unit 4:
Introduction of Operational Amplifier, Basic Operational Amplifier Circuit, Block-Daigram of Op-amp, Differential Amplifier, Inverting and Non-inverting Amplifier

Unit 5:
R-C Oscillator, L-C Oscillator, Wein Bridge Oscillator, Crystal Oscillator, Multimeter: DVM, CRO and their applications

Reference:

1. Milliman Halkias Integrated Electronics Tata McGraw Hill
2. Boylestad Nasheliky Electronic Devices and circuit Theory Pearson Education
3. Mottershead Electronic Devices and circuits Prentice Hall India

BI/BT 211 -Computer System & programming (Lab)

(L: 2: T: 0) **Max.Marks:100**

Unit 1:
Basic Computer Organization, Central Processing Unit, Data Representation, Number systems, Binary arithmetic, Introduction to Basic Input and Output Devices, Primary Memory & Secondary Memory, Various storage Units

Unit 2:
Fundamental of operating system, The idea of Program Execution at micro level, Elementary ideas on windows, Fundamental concept of programming, Introduction to c programming, Various data types, Conditional Statement, Loops, Arrays, Pointers, Structures,

Unit 3:
Basic Programming in C++, Object programming concept, Function Overloading, Dynamic data and Classes, Dynamic Binding and Virtual functions,

Unit 4:
Overview of DBMS, Basic DBMS terminology, Data Base system v/s file system, Architecture of a DBMS, Introduction to data models: entity relationship model, hierarchical model: from network to hierarchical, relational model, comparison of network, hierarchical and relational models,

Unit 5:
Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Introduction to SQL, Types of SQL commands

Reference:

1. Gear, C.W.” Computer Organization and Programming”, MC GrawHill
2. Mano, M. M.”Computer System Architecture, PHI
3. Tanenbaum, “Operating System Design & Implementation, PHI
4. Stalling, William,” Operating System” Maxwell McMillan International Editions
5. Rajaraman, V,”Introduction to Computer”
6. Korth, H. “Database Management System”
7. Venugopal, “Mastering in C++”

SECOND YEAR
Semester III

BI/BT 301 – Mathematics III

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Solution in Series of second order Linear differential equations with polynomial coefficients , Bessel and Legendre's equation and their solutions , properties of Bessel functions and Legendre polynomials , Associated Legendre's functions.

Unit 2:
Fourier series , Half-range series , Harmonic analysis.

Unit 3:
Laplace transform of elementary functions , Shifting theorems , Transforms of derivatives , Differentiation and Integration of transform , Heavisides , unit step and Dirac delta functions , Solution of Ordinary Linear differential equations used Electric circuits and bending of beams.

Unit 4:
Fourier sine and cosine transform , Fourier integral formula , application of solution of boundary value problem , Z – transform , Linearity , Z – transform of elementary functions , Shifting theorem , Convolution theorem , Inversion of Z – transform.

Unit 5:
Probability , Mathematical Expectation , Binomial , Poisson and Normal distributions , Moments and Moment generating function.

Reference:

1. B.S.Grewal - Higher Engineering mathematics
2. R.S.Agraval - Mathematics I

BT 302 – Fluid Mechanics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Fluid Statics- Newtonian and Non –Newtonian fluids, Pascal's Law, Hydro static Law, Hydrostatic forces on submerged surfaces, Buoyancy and Flotation

Unit 2:
Kinematics of fluids- Classification of fluids, Stream lines, Path lines and streak lines, Equation of continuity.
Fluid Dynamics- Energy and it' forms, Euler's equation- along stream line; In the Cartesian coordinates, Bernoulli's equation from Euler's equation, Impulse momentum relationship, Applications- Principle of hydraulic siphan, Venturimeter

Unit 3:
Flow Measurement Through Pipes- Concept of friction factor in pipe flow, Losses of energy in pipes, Hydralic gradient and total energy line
Flow Measurement Through Open Channels- Classifications of flow in channels, Discharge through open channel by Chezy's formula Empirical formula of Chezy's constant, Most economical section of channels

Unit 4:
Dimensional Analysis and Similitude- Introduction Dimensional homogeneity, Methods of Dimensional analysis , model Analysis , Similitude- types of Similarities , Types of forces Acting in moving fluid , Dimensionless numbers , Model laws or similarity laws , model testing of partially submerged bodies , Classification of models.
Unit 5:
Pumps and Compressors- Introduction of Pumps, centrifugal pump, Pressure Change in a pump, Velocity Vector Diagram and Work done, Pump losses and efficiencies ,Centrifugal compressors- work done and pressure rise, power input Factor Losses in centrifugal compressors, Compressor characteristics

Reference:

1. S.K. Som & Biswas- Introduction to Fluid Mechanics and Fluid Machines
2. Dr. D.S.Kumar- Fluid Mechanics and Fluid Power Engineering
3. Dr.R.K.Bansal -A Textbook of Fluid Mechanics and Hydralic Machine
4. franzini Mcgraw Hill ISE- Fluid Mechanics with Engineering Application
5. S.K.Agarawal (T.M.H.)-Fluid Mechanics and Machinery

BT 303 – Thermal Science

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Thermodynamics-Introduction, System and Surrounding, State properties and processes, Energy Transfer across Boundary. Heat and work.

Unit 2:
Thermodynamics-Zeroth law, Concept of Thermal Equilibrium. Equation of State Ideal and Real Gases. First Energy equation for Non flow and Steady flow process, Carrot cycle and its Efficiency ,clausis Inequality

Unit 3:
Thermodynamics -Second law, Concept of Entropy, Relation of Entropy with availability and Probability function changes in entropy .TDS diagram.

Unit 4:
Applied Thermodynamics I-Thermal Power Generation:-Air standered cycles, Otto; Diesel and Joule cycles; Introduction to Internal Combustion Engine and Gas Turbine Vapour power cycles; Rankine Cycle and modified Rankine Cycle with super heating and re-heating.

Unit 5:
Applied thermodynamics II-Introduction to modern steam power generation; Classification and working principle of boiler and various major components of Steam Turbine; Steam Nozzle and Condenser; Principles of working of Impulse and Reaction Turbine and Velocity and Pressure Compounding

Reference:

1. S.C. Garg, R.M. Bansal , C.K. Ghosh “Thermal Physics”
2. NAG ‘Engineering Thermodynamics” TMH
3. Brijlal, N. Subrahmanyam, P.S. Hemne “Heat Thermodynamics and Statistical Physics”

BI/BT 304 – Cell Biology

(L: 3: T: 0) **Max.Marks:100**
Min.Marks:35

Unit 1:
The Cell: A macromolecular assembly, cellular compartmentalization, organeller Architecture.
The Nucleus: Chromosomal DNA and its Packaging, The Global Structure of Chromosomes, Chromosome Replication, RNA Synthesis and RNA Processing, The Organization and Evolution of the Nuclear Genome.
Cytoskeleton: The Nature of the Cytoskeleton, Intermediate Filaments, Microtubules, Cilia and Centrioles, Actin Filaments, Actin-binding Proteins, Muscle

Unit 2:
Cell Junctions, Cell Adhesion, and the Extracellular Matrix : Cell Junctions, Cell-Cell Adhesion, The Extracellular Matrix of Animals, Extracellular Matrix Receptors on Animal Cells- the Integrins, The Plant Cell Wall
Membrane Structure, Transport of Molecules and Membrane Excitability: The Lipid Bilayer, Membrane Proteins, Principles of Membrane Transport, Carrier Proteins and Active Membrane Transport, Ion channels and Electrical Properties of Membranes

Unit 3:
Protein Sorting and Vesicular Trafficking in the Cell: The Compartmentalization of Higher Cells, The Transport of Molecules into and out of the Nucleus, The Transport of Proteins into Mitochondria and Chloroplasts, Peroxisomes, The endoplasmic reticulum**.,** Transport from the ER through the Golgi Apparatus, Transport from the Trans Golgi Network to Lysosomes, Transport from the Plasma Membrane via Endosome: Endocytosis, The Molecular Mechanisms of Vesicular Transport and the Maintenance of Compartmental Diversity.
Cell Signaling: General Principles of Cell Signaling, Signaling via G-Protein-linked Cell- Surface Receptors, Signaling via Enzyme-linked Cell-Surface Receptors, Kinase Receptors, Structural Features of Trans-membrane Receptors, Hormone Receptor Interaction, Two-component signaling, Second messengers.

Unit 4:
Cell Cycle and Division: The General Strategy of the cell Cycle, The Mechanics of Cell Division, The Early Embryonic Cell Cycle, Cell- Cycle control in Yeasts and Multicellular Animals.

Unit 5:
Cancer: Cancer as a Microevolutionary Process, Tumor cells, Proto-oncogenes and viral oncogenes, Tumor suppessor genes

Reference:

1. Albert et.al. John Wiley & Sons- Molecular Biology of Cell
2. Cooper. ASM Press -The Cell
3. Karp. John Wiley & Sons -Cell and Molecular Biology

BI/BT 305 – Bio molecules & Metabolism

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Molecular basis of life: Introduction to biochemistry**,** Nature & scope of biochemistry, Goals of Biochemistry, Biomolecules and their evolution, Water: weak interaction in aqueous systems, Ionization of water, weak acids, and weak bases, buffering against pH changes in biological systems, water as a reactant. Enzymes**:** Introduction, Nomenclature & classification, Enzyme Kinetics, Michaells-Menten Equation, Biological role of Enzymes.
The Energetics of life: Energy, Heat, and Work, Internal energy and the state of the system, The first law of Thermodynamics, Entropy and the second law of Thermodynamics, Free energy, Relationship between standard free energy change & equilibrium constant.

Unit 2:
Carbohydrates: General structure of carbohydrates, structure and properties of monosaccharides, biological roles of monosaccharides, structure and functions of oligosaccharides & polysaccharides. Clinical aspects, Analysis of carbohydrates.
Carbohydrate Metabolism: Glycolysis, Citric Acid cycle, Electron Transport Chain Oxidative phosphorylation, Photosynthesis: Chloroplast, Dark and Light reaction, Gluconeogenesis, Glyconeogenesis

Unit 3:
Lipids: Introduction, General structure & function, Fatty acids, Classification of Fatty acids, Classification of Lipids, Inherited Human diseases resulting from abnormal accumulations of membrane lipids.
Lipid Metabolism: Digestion, Mobilization, and Transport of fatty acids, β – oxidation of fatty acids, Oxidation of even chain saturated fatty acids, Oxidation of unsaturated fatty acids, Oxidation of odd- chain fatty acids, Fatty acid oxidation in peroxisomes, Biosynthesis of fatty acids, Biosynthesis of, triacylglycerols, Biosynthesis of membrane lipids.

Unit 4:
Proteins: Introduction to Proteins, Amino acids & Peptides, General properties of Amino acids & Peptides, Protein classification, Overview of Protein structure, Biological role of Proteins, General properties of Proteins, Dynamics, specificity and Techniques. Structural proteins: actin myosin, muscle contraction.
Protein Metabolism: Protein degradation, Pathways amino acid degradation, Nitrogen excretion and the urea cycle, Overview of Nitrogen metabolism, Biosynthesis of amino acids, inborn errors of metabolism.

Unit 5:
Nucleic acids: Introduction, Chemistry of Nucleic Acids, Types of Nucleic Acids, Biological role of Nucleic Acids.
Nucleic Acid Metabolism: Degradation and biosynthesis of Nucleic acids, De Novo synthesis of purines and pyrimidines, Salvage pathways of purines and pyrimidines.

Reference:

1. Donald voet, Judith G Voct. Charother W. Prolt, Fundamental of BioChemistry , John – Wiley & Sons
2. David L Nelson Michrel M.Cox – Lehninger Principlies of Biochemistry , W.H Freeman and Company

BI/BT 306 – Microbiology

(L: 3: T: 0) **Max.Marks:100**
Min.Marks:35

Unit 1:
Basics of microbial existence, classification and nomenclature, isolation and identification methods.

Unit 2:
Bacteria, Archeobacteria, Fungi, Viruses -Structural organization and multiplication of microorganisms, cell wall, Gram positive, Gram negative.
Nutritional Requirements, Autotrophic, heterotrophic bacteria, Growth, Growth curve, batch and continuous culture of microbes.

Unit 3:
Production of primary and secondary metabolites, Screening of new metabolites,
Strains used in screening, test systems, metabolites genes and function

Unit 4:
Preservation of food, food additives and supplements. Chemical and physical, sterilization method, Antimicrobial agents, Antibodies Sensitivity.

Unit 5:
Commercial process- Biofertilizers, Biopesticides, Biosensors. Types of Biosensors, production and used of the Biopesticides.

Reference:

1. Prescott, Harley and Kleir , Microbiology , McGraw Hill International Edition
2. Hans G Scrlrgel , General Microbiology , Cambridge university Press.

BT 307 – Material and Energy Balance

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1
Units and dimensions-Introduction, Dimensions and systems of units, Fundamental quantities, Derived quantities, Conversions, Recombination for use of units, Mole , Atomic mass and Molar mass, Equivalent mass, Degree of freedom.

Unit 2
Material balance without chemical reaction-Introduction, Process flow sheet, material balances, Graphical solution of problems, Recycling and bypassing operations.

Unit 3
Material balance with chemical reaction-Introduction, Equation for chemical reactions, Material balances involving chemical reaction, Generalized approach for solving problems, Electrochemical reactions, Recycling, parallel and bypassing operations , Metallurgical application.

Unit 4
Energy Balance-Introduction, Energy and Thermo chemistry, Energy balance, Heat capacity, Heat capacity of Gases and sensible heat changes in gases at constant pressure,
Sensible heat changes in liquids, Heat capacity of gaseous, Heat capacity of liquid mixture, Latent heat.

Unit 5
Thermo chemistry and Fuels & combustion-Enthalpy change for pure and mixture in ideal states, Use of enthalpy concentration diagram and psychometric charts.
Fuels and combustion-Fuels, type of fuels, Calorific values of fuels, Air requirement, Combustion calculations.

Reference:

1. Bhatt, B.L., VORA, S.M., " Stoichiometry ", Tata McGraw-Hill, 1976.
2. Hougen, O.A., Watson, K.M and Ragatz, R.A., " Chemical Process Principles Part-I ",
3. John Wiley and Asia Publishing, 1970.
4. Himmelblau, D.M., " Basic Principles and Calculations in Chemical Engineering ",
5. Fourth Edition, Prentice Hall Inc., 1982.
6. Whitwell, J.C., Tone, R.K. " Conservation of Mass and Energy ", McGraw-Hill, 1973.
7. Process Calculation for Chemical Engineering, Second Revised Edition, Chemical
8. Engineering Education Developement Centre, I.I.T., Madras, 1981.

SECOND YEAR
Semester IV

BI/BT 400 - Languages Lab*

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:40

*This Course of Language Lab (BI/BT 400) is compulsory, Students have to pass this course, however the marks obtained in this will not be counted for deciding the division of the student.

UNIT -I
Phonetics symbols and transcription

UNIT -II
Listening Skills and comprehension

UNIT -III
Conversation practice, perfecting English sounds, pronunciation, stress and intonation etc.

UNIT -IV
Vocabulary building, synonyms and antonyms, one word for many words commonly misspell and mispronounced

UNIT -V
Practice of Seminar presentation, Group discussion and Interview skills.

BI/BT 401 – Genetics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction-The relationship between genes and traits; Reproduction as the basis of heredity; Overview of cell division & chromosomes: Mitosis, Meiosis and homologous pairing, Mitotic chromosome, Polytene chromosome & Lampbrush chromosome, gametogenesis.
Mendalian principles of genetics-Mendels experiments; Mendels laws of inheritance Monohybrid cross; Demonstration of genetic segregation; The dihybrid cross; Trihybrid cross

Unit 2:
Gene interactions-Incomplete dominance; Codominance, Epistasis, Complementary genes; Duplicate genes; Polymeric genes; Modyfying genes.
Qunatitative or Polygenic inheritance: Inheritance of kernel color in wheat; Corolla length in tobacco; Skin color inheritance in man; Transgressive and regressive variations.
Linkage and crossing over: Morgan's work on *Drosophila* ; Crossing over; The three point cross; Double crossing over; Cytological basis of crossing over; Sex linkage; Recombination in *Neurospora ;* Construction of genetic and physical maps; Gene mapping in fungi

Unit 3:
Mutations: Chromosomal changes and gene mutations: Variations in chromosome number- Euploidy; Artificial induction of polyploidy; Aneuploidy. Variations in chromosome structure : Deletion or deficiency; duplication; translocation; Inversion; B- chromosomes.
Detections of spontaneous mutations; Cytologically visible gene mutations; Mutable genes; Induction of mutations; Ionizing radiation; UV radiation; Chemicals as mutagens; Reverse mutations; Environmental mutagens and carcinigens

Unit 4:
Population genetics: Genes and genotype frequencies; The Hardy- Weinberg Law; Non- random mating; Variation in populations; Changes in gene frequencies in populations.

Unit 5:
Genetic disorders and genetic counseling: The human Chromosome complement; Chromosomal anomalies and human disorders; Tracing the gene in family – pedigree studies; Polygenic disorders and multifactorial inheritance; Genetics of human metabolic disease; Some complex traits in families; Genetics of the hemoglobin's; Amniocentesis; Somatic cell hybrid and gene mapping; Immunogenetics. Application of genetics in agriculture and medicine.

Reference:

1. Monrose W,Strickberger, Genetics , Prentice Hall of India Private Ltd., New Delhi.
2. Klug and Cummings Concept of Genetics Pearson Education Publication , Patparganf, New Delhi

BI/BT 402 – Molecular Biology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Structure and properties of nucleic acids: Models of DNA structure; RNA structure; Physical, Chemical, Spectroscopic Nuclear & Organelle Genomes**.**
Genome Complexity: C value paradox, cot analysis, Repetitive DNA, Satellite DNA, Pseudo genes, Synteny.
Gene Organization: split genes, Overlapping genes, Transposons & Retrotransposon, Gene Clusters.
Chromosome Organization: Histones, Non- Histones, Nucleosomes, Chromatin, Chromosome structure in prokaryotes & eukaryotes

Unit 2:
DNA Replication: DNA Replication in prokaryotes and eukaryotes, d- loop & rolling circle replication, Mode of replication, enzymes and accessory proteins, Telomere replication

Unit 3:
Transcription and mRNA Processing: transcription process in eukaryotes and prokaryotes; Initiation, Elongation & Termination of transcription. Transcription factors, regulation of transcription. Types of RNAs. RNA processing and RNPs, Spliceosome, mechanism of splicing of rRNA, tRNA & mRNA, Nuclear export and stability of mRNA Capping, Polyadenylation, Splicing.
Translation: Genetic code, degeneracy of genetic code, Mechanism of Prokaryotic and eukaryotic translation, co and post translational modifications of proteins. Translational control, Regulation of gene expression in prokaryotes & eukaryotes

Unit 4:
Regulation of Gene Expression: General aspects of regulation in prokaryotes and eukaryotes, the operon, lac & trp operons; DNA Methylation; Tissue- sp. & developmental stage sp. Expression of genes. Promoter, enhancer, Operon model, Tumor suppression gene, Gene silencing, DNA binding proteins, Zink finger motif and leucine zipper.

Unit 5:
Ribozymes: Antisense and ribozymes, Antisense molecule, types & structure of ribozyme, Strategies for ribozyme technologies.
Genome Sequencing: Genome sizes, Organelle genome, strategies for sequencing genome, methods of sequencing.

Reference:

1. William H.Elliott, Daphne c.Elliotl Biochemistry and Molecular Biology , Oxford University Press
2. Robert E.Weaver ,Moleculer Biology , McGraw Hill

BI/BT 403 – Bio Physics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Chemical bonding- Ionic bond, covalent bond, energy changes, co-ordinate bond ,Werner's theory, hydrogen bonding, Vander waal's forces, nonbonded and dipolar interaction and hydrophobic interaction, conjugation and conformation.

Unit 2:
General structure of carbohydrates, protein and polypeptides. primary secondary, tertiary and quaternary structure , Ramchandran's plot, conformational analysis of proteins ,reverse folding of protein.

Unit 3:
Nucleic acid- structure of DNA and RNA , backbone torsional angle, base pairing and base stacking, types of DNA-A DNA,B DNA,Z DNA, types of RNA-m-RAN, t-RNA, r-RNA,helix to coil transition.

Unit 4:
Membrane structure and transportation of molecules across membrane, the nervous system ,nerve impulse generation, cell contractility and motility ,muscle contraction, fluidity and donnan effect.

Unit 5:
Radiation biophysics-ionising radiation, radiation sources, interaction of radiation with matter, measurement of radiation(dosimetry),radioactive isotopes. RIA, autoradiography, biological effects of radiation, effect of radiation on living system ,radiation therapy.

Reference:

1. Donald Voet , Judith G.Voet ,Charlott W pratt Fundamentals of Biochemistry ,John Wiley & Sons
2. R.S Khandpur , Hand book of Biomedical Instrumentation , Tata McGraw Hill Publication

BI/BT 404 – Instrumental Methods of Analysis

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to process variables , Direct and Inferential measurement , on and off line measurement , Static and Dynamic characteristics of instruments and their general classification , Error , accuracy , Repeatability , Drift , Threshold , Zero – stability etc., Interpretation of performance specification of transducers.

Unit 2:
Working principle of instruments, Classification of sensors and transducers based on their principle of measurement, Building block of an instrument – transducer, Amplifier, Single conditioner, Single transmitter, Data acquisition. , I/O devices (general working principle only)

Unit 3:
Instrumentation Systems , working principle of transducers/instruments employed for the measurement of Flow , Level, Pressure, Temperature , Density , Viscosity , Ph , Radiation , Composition , Humidity , Advantages and disadvantage , Preparation of instrumentation diagrams , Instrumentation diagrams , Instrumentation of important equipments like Distillation column , Heat exchanger , etc.

Unit 4:
Construction and characteristics of final control elements, Introduction to Pneumatic, Hydraulic and Electronic controllers, Pneumatic control valves, Characteristics and sizing, motorized valve etc.

Unit 5:
Signal transmission and Telemetry, sampling, Multiplexing, Modulation and Demodulation, Basic principle of DAC and ADC, Pneumatic and Electronic Transmitter and their Advantage and Disadvantage.

References:

1. A course in Electrical and Electronic measurement and Instrumention ; A.K Sawhvey , Dhanpal Rai & sons, Delhi;
2. A course in Electrical and Electronic measurement and Instrumention ;J.B Gupta; S.K Kataria & Sons; Delhi
3. Mechanical Measurement; D.S Kumar; S.K Kataria & Sons.
4. Mechanical Measurement; R.K Jain; Khanna Publication

BT 405 – Transport Phenomena

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

PART 1
Molecular transport: mechanism of momentum, heat and mass transport. Pressure & temperature dependency on viscosity, thermal conductivities and diffusivities. Theory of viscosities, conductivity and diffusitivities.

PART 2

Shell momentum balances and velocity distribution: Flow of falling film, flow through circular tube, annulus, etc.

PART 3

Shell energy balances and temperature distribution: Heat conduction with an electrical heat source, nuclear heat source, through composite walls and fins.

PART 4

Shell mass balances and concentration distribution: diffusion through a stagnant gas film, with a heterogeneous & homogeneous chemical reaction, etc.

PART 5

Equation of change and isothermal system: the equation of continuity, motion and mechanical energy. Use of equation of change to solve flow problems in long circular tubes, coquette viscometer, etc.

References:

1. Heat & Mass Transfer (HMT) by D.S Kumar , Kataria & Sons
2. Heat & Mass Transfer(HMT) by Domkundwar ,

BI/BT 406 – Technical Communication

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to Communication:-Definition, Importance and nature of Business communication – Communication Models – Process of Communication; Barriers and Gateways in communication; Developing Effective Communication skills.
Different types of communication like letters, memos, reports, fax, email, presentations, telephone, and multimedia, choosing the means of communication, stages in communication cycle, communication systems.

Unit 2:
Written Communication – I:- *Writing Techniques*: Rules of good writing, adaptation and selection of words, masculine words, writing with style- choosing words with right strength and vigour, using a thesaurus, writing effective sentences, developing logical paragraphs, overall tone, drafting, editing and finalizing the business letters – Commercial letters; Preparation of Office Order, Memo, Indents; Recent Developments in Communication Technology; Do's and don'ts of Business writing; Legal aspects of Business communication

Unit 3:
Written Communication – II:-*Recruitment and employment correspondence*: Application letter, curriculum vitae, interview, references, offer of employment, job description, letter of acceptance, letter of resignation.
Internal communications: memoranda, reports: types of reports, formal reports and informal reports, meetings, documentation.
External communications: Public notices, invitations to tender bid, auction, notices, etc; *Report writing*: planning, technique of writing a report, characteristics of business reports, common types of reports, purposes of reports; Writing Business reports

Unit 4:
Persuasive messages:-Planning the persuasive message, common types of persuasive requests, principles of persuasive communication.
Effective communication and impact of information technology, Oral communication: nature and significance; Written and oral communication presentation of Business Reports; Public speaking and negotiations.

Unit 5:
Reformulating and summarising:- What is a summary? Using synonyms & antonyms, reducing phrases, guidelines for writing summaries, business summaries. *Comprehension*: using a dictionary, grammatical precision, phonetics, contextual clues, guidelines for comprehension.

Reference:

1. Sharma R.C.and Mohan K "Business report Writing and Correspondence" Tata McGraw-Hill, New Delhi
2. Lesikar R V and Pettit Jr J D- *Business Communication: Theory and Application* (Tata McGraw-Hill, 2002)
3. Tayler Shinley - *Communication for Business* (Pearson Education, 2002)
4. Bovee C L et al- *Business Communication Today* (Pearson Education, 2002), New Delhi
5. Hargie O et al- *Communication Skills for Effective Management* (Palgrave, 2004)
6. T N Chhabra, Bhanu Ranjan – Business Communication (Sun India, 2004)
7. P.D. Chaturvedi – *Business Communication* (Pearson Education)
8. Meenakshi Raman-Technical Communication- (Oxford University Press)
9. Murphy H.A. and Peak C.E., "Effective Business Communication" 2nd Ed. Tata McGraw-Hill, New Delhi
10. Pearce C.g. "Business Communications; Principles and Applications" 2nd Ed. John Wiley, New York
11. R.K.Madhukar, Business Communication and Customer Relations, Vikas Publishing House, 2001
12. Krishna Mohan, Meera Banerji: *Developing Communication Skills*, Macmillan India Ltd., 2002
13. Matthukutty M. Monipally, Business Communication Strategies, Tata McGraw-Hill, New Delhi, 2003

THIRD YEAR
Semester V

BI/BT 501 – Management Concepts and Practices

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to management; Evolution of Management thoughts Management processes and functions. Understanding organizational design and structure.

Unit 2:
Marketing: The concept of marketing mix; mix of product policy and design. Pricing. Choice of marketing intermediates. Methods of physical distribution. Uses of personal selling. Advertising and sales promotion. Introduction to marketing research and marketing organization.

Unit 3:
Finance : finance function. Concept, scope and its relationship with other functions. Tools of financial analysis (funds and cash flow analysis, ratio analysis) Risk-return-trade off. Financial forecasting. Estimation and management of working capital.

Unit 4:
Manufacturing: operations planning and control. Management of supply chain; Introduction to materials management; Systems and procedure of inventory management planning and procurement of materials.

Unit 5:
Quality management- Concept and definition of quality, quality cost, statistical quality control, control charts, acceptance sampling, Maintenance types and cost. *Strategy*-: firm and its environment: Strategies for growth and diversification: process of strategic planning

Reference:

1. L.M. Prasad: Principles & Practices of Management
2. J.S.Chandan, Management Concepts and Strategies, Vikas Publishing House, 2002.
3. Koontz, Essentials of Management, Tata McGraw-Hill, 5th Edition, 2001
4. Koontz, Weihrich & Aryasri, *Principles of Management*, TMH, New Delhi, 2004
5. Jain & Sharma "Functional Management"
6. R. L. Nolkha "Functional Management", Adarsh Prakashan
7. R.D. Agarwal "Organisation & Management"
8. Gandhi J.C. "Marketing: A Managerial Introduction" Tata McGraw Hill, New Delhi
9. Kotler Philip, 'Marketing Management', 11th Ed., Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
10. Kotler & Armstrong; *Principles of Marketing Management*, Prentice hall India, 2003.
11. Pandey, I.M.; *Financial Management*, Vikas Publishing House, 8th Edition, 2001.
12. M.D. Agrawal & N.P. Agrawal "Financial Management" Ramesh Book Depot, Jaipur.
13. Chary, S N. *Production and Operations Management.* New Delhi, Tata McGraw Hill, 2002
14. Elwood S. Buffa, Rakesh K. Sarin, Modern Production and Operations Management, John Wiley & Sons,NY
15. Ansoff, H Igor. *Implanting Strategic Management.* Englewood Cliffs, New Jersey, Prentice Hall Inc., 1984
16. Kazmi A. "Business Policy and Strategic Management" Tata McGraw-Hill, New Delhi

BI/BT 502 – Genetic Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction and historical background; Restriction and modifying enzymes; Cloning vectors: Plasmids, phage cosmids, phasmid, YAK, eukaryotic vectors.

Unit 2:
Isolation, purification and characterization of DNA and RNA; construction of genomic and cDNA libraries.

Unit 3:
Synthesis and labeling of DNA and RNA probes, random primer, nick translation, End labeling; Screening of cDNA and genomic libraries, hybridization probe methods; antibody screening; Gene cloning.

Unit 4:
Polymerase chain reaction for DNA amplification, Modification of polymerase chain reaction; DNA sequencing; Maximum-Gilbert, Sanger's and Automatic method; Site directed mutagenesis.

Unit 5:
Genetically modified organism; Risk assessment, biosafety regulations and guidelines.

Reference:

1. Brown T.A Gene cloning and Analysis Black well Science Limited
2. James D.Watson and Gilmar , Recombinant DNA W.H Freeman and company NewYork

BI/BT 503 – Biochemical Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:40

UNIT-1
Introduction to Biochemical Engineering: Conventional chemical processes and biochemical processes-an overview of industrial biochemical processes with typical examples, comparing chemical and biochemical processes, development and scope of biochemical engineering as a discipline, application of biochemical engineering.
Introduction to Biochemistry : Lipids, Sugar and Polysaccharides, DNA and RNA (Building blocks, and energy carrier, co- enzymes, biological information storage DNA and RNA), Amino acids into proteins (amino acids building blocks and polypeptides, protein structure),Hybrid biochemicals , The hierarchy of cellular organization.

UNIT -2
Metabolism and Energetics: Thermodynamic principals, metabolic reaction Coupling: ATP and NAD, Carbon catabolism, Respiration (TCA cycle, Respirative chain) Photosynthesis (Light harvesting, electron transport and potophosphorylation,) Biosynthesis (Synthesis of small molecules, macromolecules synthesis) Transport across cell membranes, Metabolic organization and regulation, End products of metabolism, Stoichiometry of cell growth and product formation.

UNIT -3
Kinetics of biochemical reaction and microbial fermentation: Ideal reractors for kinetics Measurements(Ideal batch reactor, continuous – flow stirred- tank reactor) Kinetics of balanced growth, Transient growth kinetics, Structured kinetic models, Product formation kinetics, Segregated kinetic models of growth and product formation, Thermal death kinetics of cells and spores.
Product Recovery Operations- Recovery of Particulates: Cells and Solid Particles, Product isolation, Precipitation, Chromatography and Fixed –Bed Adsorption: Batch Processing with Selective Adsorbates, Membrane Separation, Electrophoresis, Combined Operations (Immobilization, whole broth Processing, Mass Recycle), Product Recovery Trains. Immobilized –Enzyme Technology, Immobilized Enzyme Kinetics.

UNIT-4
Heat and mass transfer in biochemical processes, Gas-liquid mass transfer in cellular system (Basic mass-transfer concepts, rates of metabolic oxygen utilization) Determination of oxygen transfer rates, Mass transfer for freely rising or filling bodies, forced convection mass transfer, Mass transfer across free surfaces, Non-Newtonian fluids, scaling of mass transfer equipment, heat transfer, sterilization of gases and liquids by filtration.

UNIT-5
Design and Analysis of Bioreactors - Ideal bioreactors, Reactor Dynamics, Reactors with Nonideal mixing, sterilization reactor, Immobilized Biocatalysts, Multiphase Bioreactors,
Fermentation technology, Animal and Plant cell Reactor Technology.
Instrumentation and Control- Physical and Chemical Sensors for the Medium and Gases,
On-Line Sensors for cell properties, Off-Line Analytical Methods, Computers and Interfaces, Data Analysis, Process Control, Advanced Control Strategies.

Reference:

1. James E. Bailey & David F. Ollis- Biochemical Engineering Fundamentals

BT 504 – Microbial Technology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Selection of microorganisms, Screening for metabolites.
Strain improvement-mutagenesis, genetics basis.

Unit 2:
Raw materials for industrial fermentation and its uses-Molasses, corn starch, whey, wheat, starch, maltodextrins
Submerged fermentation, Surface fermentation, Solid state fermentation.

Unit 3:
Immobilization of whole cell and enzyme.
Production of organic Solvents- ethanol, acetone, glycerol,
Production of organic Acids-citric acid, gluconic acid, lactic acid,
Production of Amino acids-Glutamic acid, and Lysine.

Unit 4:
Production of antibiotics, beta-lactam and peptide antibiotics,
Production of polysaccharides, Biosurfactants, Types and application, Production of enzyme from microbial, plant and animal sources.

Unit 5:
Genetic engineering-DNA isolation, sequence for cloning and risks, purification and Recovery of enzymes, Large Scale Production, fermenters, economics, Legislative and safety Aspects.

Reference:

1. T.A Brawn ,Gene cloning & DNA Analysis ,Blackwell Science Publication
2. wulf crueger & Anneliese ctcueger , Biotechnology ,A text Book of Industrial Microbiology , Panima Publishing corporation , New Delhi

BI/BT 505 – Immuno Technology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction: Innate and acquire immunity, active, passive and adoptive immunization, clonal selection theory, humoral and cellular immunity, Regulation of immune response. Cellular responses; Activation and function of T and B cells, general properties and functional categories of cytokines, therapeutic and diagnostic exploitation of cytokines and cytokine receptors.

Unit 2:
Major Histocompatibility Complex (MHC) in the human response, infection and immunity; Host defense against various classes of pathogen, mechanism by which pathogen invade immune responses, active and passive immunization, preparation of human immune serum globulins.

Unit 3:
Transplantation and tumor immunology; Relationship between donor and recipient, role of MHC molecules in Allograft rejection, Bone marrow and Hematopoietic stem cell transplantation, Tumor antigen, categories of tumor antigen, tumor immunoprophylaxis.

Unit 4:
Autoimmunity: Criteria and causes of autoimmune diseases Autoimmune hemolytic anemia, myasthenia gravis, systemic lupus erythematosus, multiple sclerosis, rheumatoid arthritis.

Unit 5:
Applied immunology: Antigen and antibody interactions, Affinity and Avidity, Agglutination and precipitation reactions, Immunoassays Immunofluorescence, Fluorescence-Activated Cell-Sorting Analysis Microarrays to assess gene expression.

Reference:

1. Roitt I , Male David , Brostoff and Broth B, Immunology , Morby Elsevier Limited , International Edition
2. Kuby , Imunology , W.H Fruman and company , New York

BT 506 – Bioinformatics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction, Database model, raw database and progressed database, data mining, Data storage and retrieval, Entrez, tools for querying-BLAST, FASTA.

Unit 2:
Gene finding, hidden Markov models (HMM).Annotation of protein sequence,

Unit 3:
Sequence alignment: pair wise, local, global, multiple sequences alignment, Clustering, protein- Protein interaction, Binding site prediction Phylogenetic tree analysis. Substitution matrices: PAM, BLOSUM

Unit 4:
Structure database, protein structure database (PBD), Homology modelling, Comparison and superposition of structure, Comparison of distance matrices, searching for pattern and motifs.

Unit 5:
Human Genome, Evolution of protein structure and sequence by comparing different organism, Micro array, Bio Chips, Database for Functional Genomics, ,

Reference:

1. Bioinformatics-A Beginner's Guide by jean-Michel Claveri, Cedric Notredame,
2. Wiley dreamtech India Pvt.Ltd.
3. Bioinformatics sequence & Genome Analysis by David w,mount,CBS Publisher & Distributors
4. Biological Sequence Analysis(Probalistics Model Of Proteins & Nucleic Acids) by R.Durbin, S.Eddy, A.Krogh, G.Mitchison
5. Bioinformatics methods & Protocols-Stephen Misener, Stephen A.Krawetz, Humana Press.

THIRD YEAR
Semester VI

BI/BT 601 – Economics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Basic Economic Concepts; *Market Demand & Production Analysis for Decision Making*: Objectives of demand analysis and determinants of demand; Law of Demand, Elasticity of demand and its measurement methods; Importance in decision-making; Demand forecasting methods demand functions,

Unit 2:
Theory of production - Production concepts and analysis; Production function; Characteristic of various factors of production; Laws of production – Law of Variable Proportion and Returns to Scale; Cost concepts and analysis; Different types of cost, short-run and Long-run Average costs curves and its analysis; Break-even analysis.

Unit 3:
Market Structure; Pricing Decision: Pricing and output decision under prefect and imperfect competition, oligopoly and monopoly, pricing methods products line pricing, specify pricing problems, price discrimination, price forecasting. Economic Appraisal Techniques;

Unit 4:
Concepts in International Trade - need, importance, process and problems; Money; & Capital Markets; Banking- Definition of banker and customer; general and special relationship, termination of relationship, pass book, types of accounts and their operations;

Unit 5:
Business Cycles; Inflation; Balance of Payments and Exchange rate determination;; Government Budgeting and Related Fiscal Concepts: Indian Industries.

Reference:

1. Diwedi, D.N.; *Managerial Economics,* Vikas Publishers, 2003.
2. Dwivedi, D.N.; *Microeconomics: Theory and Applications*, Pearson Education, 2003.
3. Rajkumar and Kuldeep Gupta "Managerial Economics"
4. Chaturvedi, D.D. and S. L. Gupta; *Managerial Economics,* Brijwasi Publishers, 2003.
5. Mote V.L. & Gupta G.S.: Managerial Economics- Concept and cases. Tata Mc Graw Hill, New Delhi.
6. Ozha BL 'International trade and finance' Adarsh Prakashan, Jaipur
7. Rangaragam C. & Dholakia H. Macroeconomics, Mc Graw Hill, New Delhi.
8. Varshney R.L. & Maheshwarin K.L.: Managerial Economics, Sultan Chand & Sons, New Delhi.
9. Mehta, P. L.; *Managerial Economics,* Sultan Chand & Sons., 2003.
10. Koutsoyiannis, A.; *Modern Micro Economics,* Macmillan Press Ltd., 2003.
11. Peterson, Lewis; *Managerial Economics,* 4th Pearson Education, 2002.
12. M.L. Seth--Principles of Economics, Laxmi Narain Agarwal, Agra.
13. M.L. Jhingan--Principles of Economics, Vikas, New Delhi.
14. Paul A. Samuelson--Economics, McGraw Hill International, New York.
15. N.D. Mathur--Business Economics, Shivam Book House (p) Ltd., Jaipur.
16. D.M. Mitthani--Fundamental of business and Managerial economics-Himalaya Publishing House, Bombay.
17. U.L. Mote, Semuel Paul and G.S.Gupta--Managerial Economics, Tata Mcgraw Hill, Bombay.

BT 602 –Plant Biotechnology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
History of plant tissue culture, Introduction to cell and tissue culture, laboratory organization and tissue culture media. Composition and preparation, single cell clones, Initiation & maintenance of callus and suspension culture.

Unit 2:
Organ culture somatic embryogenesis synthetics seed, protoplast isolation, culture and fusion. Application of protoplast culture, Somaclonal variation.,Cryopreservation, germ plasm conservation, Hybrid and Cybrid.

Unit 3:
Production of haploid plants (anther culture embryo culture and embryo rescue, Plant regeneration hardening transfer and establishment of whole plants in soil, Micro propagation of diseases free plants.

Unit 4:
Biotransformation, production of secondary Metabolites, physical methods of Transfer of gene to plant, Vector less and Vector mediated transformation, Transgenic plants and their commercialization.

Unit 5:
Development of insect resistance herbicides salt and drought resistance plants, Molecular markers and construction of map, Molecular maker added breeding RFLP maps linkage analysis, RAPD markers, STS (micro satellite) Greenhouse Technology.

Reference:

1. H.S Chawla – Introductation to Plant Biotechnology Oxfored and IBH publication
2. S.S Bhajwani M.K Razalan Studies in Plant Science
3. Plant Tissue culture – North Holland

BT 603 – Animal Biotechnology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to Animal Tissue Culture: Background, Advantages, Limitations, Application, Culture Environment, Cell Adhesion, Cell Proliferation, Differentiation.
Design, Layout and Equipment: Planning, Construction, Layout, Essential Equipments, Aseptic Technique, Objectives, Elements, Sterile Handling, Safety, Risk Assessment, General Safety, Fire, Radiation, Biohazards
Media: Physicochemical Properties, Balanced Salt Solutions, Complete Media, Serum, Serum-Free Media, Disadvantages of Serum, Advantages of Serum-Free media

Unit 2:
Primary Culture: Isolation of Tissue, Steps involved in primary cell culture, Cell Lines, Nomenclature, Subculture and Propagation, Immortalization of cell lines, Cell line designations, Routine maintenance
Characterization & Quantitation of Cell Line: Need for characterization, Morphology, Chromosome Analysis, DNA Content, RNA and Protein, Enzyme Activity, Antigenic Markers, Transformation, Immortalization, Aberrant Growth Control, Tumorigenicity, Cell counting, DNA content, Protein, Rates of Synthesis, Cell Proliferation, Plating Efficiency, Labeling Index, Generation Time

Unit 3:
Contamination: Source of contamination, Type of microbial contamination, Monitoring, Eradication of Contamination, Cross-Contamination
Cryopreservation: Need of Cryopreservation, Preservation, Cell banks, Transporting cells
Cytotoxicity: Introduction, In vitro limitations, Nature of assay, Viability assay, Survival assay, Microtitration assay, Transformation assay

Unit 4:
Transgenic Animals: Methodology, Embryonic Stem Cell method, Microinjection method, Retroviral vector method, Applications of transgenic animals
Gene Therapy: Ex-vivo gene therapy, In vivo gene therapy, Viral gene delivery system, Retrovirus vector system, Adenovirus vector system, Adeno-Associated virus vector system, Herpex simplex virus vector system, Non-viral gene delivery system, Prodrug activation therapy, Nucleic acid therapeutic agents

Unit 5:
In Vitro Fertilization and Embryo Transfer: Composition of IVF media, Steps involved in IVF, Fertilization by means of micro insemination, PZD, ICSI, SUZI, MESA

Reference:

1. Animal Cell Culture by John R.W. Masters Oxford University Press
2. Introduction to Cell and Tissue Culture by Jennie P. Mather and Penelope E. Roberts Plenum Press, New York and London
3. Molecular Biotechnology: Primrose.
4. Animal Cell Biotechnology: R.E. Spier and J.B. Griffiths (1988), Academic press.

BI/BT 604 – Bio Medical Instrumentation

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Light Microscopy, Electron microscopy-TEM,SEM,, Spectrophotometer Light measurement: Nature of light, Basic spectroscopy, UV/visible spectrophotometer, Fluorescence spectrophotometer, Phosphorescence and luminescence, Infra-red (IR) and Application of Infra-red (IR) and Nuclear magnetic resonance and Mass spectrometry (MS).

Unit 2:
Medical Imaging: Diagnostic X-rays. X- Ray Machine ,dental image intensifier system, table shooting and maintenance of X- Ray machine Safety Aspect of Medical Gross current, Micro Current shock, safety standards rays and considerations, safety testing instruments, biological effects of X-rays and precautions, CAT, MRI, thermography, ultrasonography, medical use of Isotopes, endoscopy.

Unit 3:
Bioelectric signals and their recording ,Bioelectric signals (ECG, EMG, ECG, EOG & ERG) and their characteristics, Bioelectrodes,electrodes tissue interface, contact impedance, effects of high contact, impedance, types of electrodes, electrodes for ECG, EEG and EMG.

Unit 4:
BLOOD FLOW AND BLOOD CELL COUNTING ,Electromagnetic and ultrasonic blood flow meter, indicator dilution method, thermo dilution method, manual and automatic counting of RBC, WBC and platelets, cardiography: Phonocardiography, vector cardiography, Echocardiography pacemaker, defibrillators, Ventilator..

Unit 5:
Electrophoresis, Isoelectric focusing (IEF), Two-dimensional electrophoresis
Measuring radioactivity: The Geiger-Muller (G-M) counter, The scintillation counter, Autoradiography, Biological applications for radioactive isotopes, Working practices when using radioactive isotopes

Reference:

1. Medical Instrumentation by John. G. Webster –John Wiley
2. Principles of Applied Biomedical Instrumentation by Goddes & Baker – John Wiley
3. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson
4. Biomedical Instrument by Cromwell-Prentice Hall of India, New Delhi
5. Hand book of Biomedical instruments by R.S. Khandpur –TMH, New Delhi
6. Medicine and Clinical Engineering – By Jacobson and Webster, (PHI)

FOURTH YEAR
Semester VII

BT 701 – Environmental Biotechnology

(L: 2: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to Environmentol Biotechnology & Its Scope and application, Waste Water (Sewage & Industrial efficients) treatment:- Anaerobic and aerobic treatment; Methanogenesis, Methonogenic, acetogenic and fermentative bacteria- technical process and condition, energing Biotechnological processes in waste-water treatment.

Unit 2:
Solid waste management: landfills, composting, eartheorm treatment (vermicomposting). Recycling and processing of organic residues.

Unit 3:
Biodegradation of Xenobiotic compounds, Organisms (bacteria & fungi) involved in degradation of chlorinated hydrocarbons, PCB Degradation.

Unit 4:
Mining and metal Biotechnology:- Microbial transformation, Bioaccumulation and concentration of metals, Metal leaching, Biomagnification

Unit 5:
Environmentol Genetics:- Degradative plasmids, Release of genetically engineered microbes in environment. Impact of GEMs on environment & public health.

Reference:

1. Puadipta Kumar Mohapatrr , text book of Environmental Biotechnology , Ik International
2. Indu shekhar Thakur , Environmental Biotechnology I K International
3. R.C Dubey and D.K Maheshwari , A text of Microbiology , S.Chand and company ltd.

BT 702 – Down Stream Processes

(L: 2: T: 1) **Max.Marks:100**
Min.Marks:35

Unit I: Role of Downstream Processing in Biotechnology

Rol and importance of downstream processing in biotechnological processes. Problems and requirements of bioproduct purification. Economics of downstream processing in Biotechnology, cost-cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high value products)

UNIT-II: Physico-chemical basis of bio-separation processes.

Recent development in product isolation (for ex. one step purification, reverse Micro cellular extraction on line membrane separation). : Primary Separation and Recover Process -Cell disruption methods for intracellular products, removal of insoluble, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

Unit III: Membrane separations and Enrichment Operations :

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

Unit IV: Product Resolution / Fractionation

Chromatographic techniques- Paper, TLC, Adsorption, Ion exchange, Gel filtration,affinity chromatographic separation processes, GC, HPLC, electrophoretic separations techniques.

Unit V: New and Emerging Technologies

Dialysis, Crystallization, evaporation, super liquid extraction foam based separation case study with examples for processing of Two Industrial Products (Citric acid / Penicillin and Low volume high value product like recombinant proteins).

References:

1. Wankat PC. Rate controlled separations, Elsevier, 1990.
2. Belter PA and Cussler E. Bioseparations, Wiley 1985.
3. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH, 1990.
4. Asenjo J.M. Separation processes in Biotechnology, 1993, Marcel Dekkere Inc.
5. Bioseparations by Siva Shankar PHI publications

BI/BT 703 – Bio safety, Ethics, Patenting and IPR

(L: 2: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction; Genetic engineering; safety, social, moral and ethic consideration; Environmental ethics cell research;
WTO: As an international agency controlling trade among nations. WTO with reference to biotechnological affairs, TRIPs.
General Introduction: Patent claims, the legal decision – making process, ownership of tangible and intellectual property.

Unit 2:
Basic Requirements of Patentability Patentable subject matter, novelty and the public domain, non obviousness.
Special issues in Biotechnology Patents Disclosure requirements, Collaborative research, Competitive research, plant.

Unit 3:
Plant biotechnology Indian patents and Foreign patents, Plant variety protection act, The strategy of protecting plants.
Patent Litigation Substratitive aspects of patent litigation, Procedural aspects of patent litigation, different Doctrines, Recent Developments in Patent System and Patentability of biotechnological inventions.

Unit 4:
Unit 4: public acceptance and safety of new biotechnology food; Agro biodiversity and donor policies;**IPR issues in Indian Context** Role of patent in pharmaceutical industry, computer related innovations.

Unit 5:
Patents, copyrights,Trademark;Salients features: patent Act(1970),Patent (Amendments) Act (2002)different types of patent and Filling and processing of Application for Patents; Biopiracy and Biocolonialism
Case studies Rice, Haldi, neem, etc. and challenges ahead

Reference:

1. The law and strategy of Biotechnological patents by Sibley. Butterworth publications.
2. Intellectual property rights – Ganguli – Tat McGraw-Hill
3. Intellectual property right – Wattal – Oxford Publishing House.

FOURTH YEAR
Semester VIII

BI/BT 803 – Project

(L: 2: T: 1) **Max.Marks:400**
Min.Marks:35

The project work will be spread in the seventh and eight semesters. The topic of the project will be approved by the Head of the Department and the entire project work will be carried out under the guidance of a department project supervisor approved by the Head of the Department. The nature of the project work will consist of varying properties of designing, fabrication, testing and analysis of result. The project topic can also be taken from a live industrial problem. The report of the completed project shall be signed by the guide and submitted to the Head of the Department on or the working day of the eight semesters. The evolution of the project will be done by the board consisting of an internal and an external examiner.

Electives
Group-A-I:

BT-A-I-1 – Bio-Diversity, Bioprospecting, Organic Farming

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
The multidisciplinary nature of environment studies, ecosystem, concept of ecosystem. Structure and function of ecosystem, major ecosystem and their flera and fauna; co-evaluation, symbiosis and interaction among organisms.

Unit 2:
Biodiversity and its conservation – introduction, definition, genetic, species and ecosystems diversity, Biodiversity at global, national and local level. Hot spots of biodiversity. Endangered and endemic species of India. Wild life protection act

Unit 3:
Analysis of biodiversity, on frame, ex-situ, in-situ and gene bank conservation. geological and human activities endangering biodiversity , desertification and utilization of biodiversity.

Unit 4:
Bioprospecting Biodiversity for food, feed health care and other products. Ethnobiology, IPR: patenting.

Unit 5:
Organic farming and sustainable use of nature and bioresources; organic standards and certification of organic produce and products, Global initiatives on future prospects.

Reference:

1. Pradipta Kumar Mohapatra, ' Text Book of Environmental Biotechnology', I.K International Publication.
2. P.D. Sharma, 'Fundamentals of Ecology', S. Chand Publication

BT-A-I-2 – Biological Spectroscopy

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Electromagnetic Radiation: Ultraviolet-visible-infra red spectra of amino acids, peptides, proteins, nucleic acid bases

Unit 2:
Fluorescence spectra of amino acids/peptide/ biomolecules; Optical rotator dispersion and Circular dichroism spectroscopy, Raman, Moss Bauer and pico second spectroscopy.

Unit 3:
Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR, spin-spin coupling, 1D, 2D NMR methods, COSY, NOESY, structure determination.

Unit 4:
Electron paramagnetic resonance (EPR) spectroscopy.

Unit 5:
MRI: X-ray Diffraction and structure determination.

References

1. Wilson K. and Walker J.(2006).'Principles and Techniques of Biochemistry and Molecular Biology'. Cambridge University Press, 6th Edition.
2. Freifelder D. 'Physical Biochemistry'. W.H.Freeman and Company, New York, 2nd Edition.

BT-A-I-3 – Food Biotechnology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction: factors affecting the growth &survival of microorganisms in food, Microbial spoilage of food-milk, meat, plant products.

Unit 2:
Food borne diseases; Bacterial agents of food borne illness-clostridium, Listeria, Salmonella, Shigella, Staphylococcus, Vibrio ,Yersinia, Non-bacterial agents of food borne illness-helminthes and protozoa toxigenic algae, toxigenic fungi, food borne viruses

Unit 3:
Fermented and microbial foods; fermented milk, cheese, sauerkraut, fermented meat, beer, vinegar, mould fermentation.

Unit 4:
Microbiological examination of foods; direct examination, culture techniques, MPN count, Dye reduction assay, immunological methods, advance techniques

Unit 5:
Microbiology of food preservation; physical, chemical, and biological base preservation system; Quality control using microbiological criteria; facilities and operation, cleaning and disinfection code for good manufacturing practices, hazard analysis and critical control points, record keeping

References

1. Prescott, Harley and Klein, ‘ Microbiology’, MC Graw Hill, International Edition.
2. Willian C. Fraizier and Dennis C. Westhoff, ‘Food Microbiology’, Tata McGraw Hill Publishing Company , New Delhi.

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Group-A-II:

BT-A-II-1 – Genetically Modified Organisms

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
History of recombinant DNA and guidelines for research; Methods of gene cloning and cloned genes; Selectable markers and reporter gene

Unit 2:
Promoters and transformation cassettes; Transformation methods

Unit 3:
Charaterization of GMOs; Toxicological and allergenicity assessment; Regulatory agencies and commercialization; GMOs for resistance against abiotic stresses; GMOs for improved nutritional quality and shelf life.

Unit 4:
GMOs for engineered enzymes, proteins and pathways, GMOs for porcuctional pharmaceutical proteins

Unit 5:
Gene therapy for congenital and other diseases; Risk assessment, IPRs and ethical issues

References

1. M. M. Ranga , ‘ Animal Biotechnology ’, 2nd Edition, Agrobios (India) .
2. Brown T.A., ‘ Gene Cloning and Analysis’, Black well Science Ltd.

BT-A-II-2 – Genomics and Proteomics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Genome evolution and organization in prokaryotes and eukaryotes; Genome sequencing, basics, strategies, and methodology; Databases and sequence comparisons;

Unit 2:
Comparative genomics, Functional genomics, ESTs and SAGE; Microarray and its applications; Allele mining and SNPs;

Unit 3:
Proteomics: Introduction, proteomics and proteome, protein databases; Tools of proteomics: Analytical protein and peptide separations, High throughput proteome analysis with 2DIEF, protein digestion techniques,

Unit 4:
Mass spectrometry; peptide sequencing analysis by tandem mass spectrometry data; Mass-Finger printing, Protein-Protein interactions

Unit 5:
Applications of genomics and proteomics: mining genome proteomes, protein expression profiles, mapping protein modifications, new directions.

References

1. Donald Voet, Judith G. Voet, 'Fundamentals of Biochemistry', John Wiley & Sons, INC (2006) Publication, 2nd Edition.
2. Wilson K. and Walker J.(2006).'Principles and Techniques of Biochemistry and Molecular Biology'. Cambridge University Press, 6th Edition.

BT-A-II-3 – Metabolic Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to Metabolism and Metabolic Engineering; Comprehensive models for cellular reactions; Fermentation and Cell Cultures; Transport across Cell membrane;

Unit 2:
Enzyme Kinetics: Analysis of sequences of reactions; Methods to alter Gene expression

Unit 3:
Metabolic networks; Regulation of metabolic networks; Metabolic Control Analysis;

Unit 4:
Functional Genomics: Microarrays, Proteomics; Metabolomics, Bioinformatics for reconstruction of metabolic networks;

Unit 5:
Systems Biology frameworks for metabolic engineering

References

1. Donald Voet, Judith G. Voet, 'Fundamentals of Biochemistry', John Wiley & Sons, INC (2006) Publication, 2nd Edition.
2. David L. Nelson, Michael M. Cox – Lehlinger 'Principles of Biochemistry', W. H. Freeman & Company, 4th Edition.

Group-A-III:

BT-A-III-1 – Protein Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Bonds and energies in protein: Covalent, Ionic, Coordinate, Hydrophobic and Vander walls interactions, interaction with electromagnetic radiation, elucidation of protein structure;

Unit 2:
Amino acids and their characteristics: amino acids, molecular properties, chemical reactivity, post-translation modification, peptide synthesis;

Unit 3:
Protein Architecture: primary, secondary, super secondary and tertiary structures; Protein folding: Folding problem, Types of folds and their topologies

Unit 4:
Structure-Function relationship: DNA binding proteins, membrane proteins, immunoglobulin, enzymes

Unit 5:
Protein Engineering: overview of methods, thermal stability of T4-lysozyme, recombinant insulin, *de nova* protein design.

References

1. Donald Voet, Judith G. Voet, 'Fundamentals of Biochemistry', John Wiley & Sons, INC (2006) Publication, 2nd Edition.
2. David L. Nelson, Michael M. Cox – Lehlinger 'Principles of Biochemistry', W. H. Freeman & Company, 4th Edition

BT-A-III-2 – Enzyme Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction -What are enzymes, History of enzymes, the naming and classification of enzymes, Mechanism of enzyme action, Michaelis- Menten equation, Enzyme inhibition: competitive,non-competitive, uncompetitive Mixed inhibition, substrate inhibition, Allosteric inhibition & Irreversible inhibition

Unit 2:
Active site determination, The identification of binding sites and catalytic sites, The use of substrate analogues, Enzyme modification by chemical procedures affecting amino acid side chains, Enzyme modification by treatment with proteases, Enzyme modification by site- directed mutagenesis, the effect of changing pH. The investigation of the three dimensional structure of active sites. Identification of binding and catalytic sites.
specificity of enzyme action: Types of specificity, The active site, The Fischer 'lock – and- key ' hypothesis, The Koshland 'induced- fit hypothesis' hypothesis involving strain or transition – state stabilization

Unit 3:
Kinetics of single substrate enzyme catalyzed reactions:
An introduction to bioenergetics, catalysis and kinetics: Concets of bioenergetics: The first and second law of thermodynamics, Enthalpy and free energy, free energy and chemical reaction, standard free energy, Bioenergetics and the living cell, Factors affecting the rate of chemical reactions: The collision theory, Activation energy and transition – state theory, catalysis. Kinetics of uncatalyzed chemical reactions, Kinetics of enzyme – catalyzed reaction, Methods used for investigating the kinetics of enzyme – catalyzed reaction.
Allosteric enzymes and metabolic regulation;
Characteristics of steady – state metabolic pathways, regulation of steady – state metabolic pathways by control of enzyme action, Allosteric enzymes and the amplification of metabolic regulation

Unit 4:
Investigation of enzymes in biological preparation:
immobilized enzymes. Immobilized enzyme catalysis, Effects of inhibitors, temperature and pH on immobilized enzyme catalytic activity and deactivation; types of reactors used for homogeneous enzyme catalysis; Immobilized enzyme catalysis; Effects of external mass transfer resistance, Industrial applications of immobilized enzymes, Analysis of Intra- particle diffusion and reaction, Simultaneous film and intra particle mass transfer resistance, Enzyme biosensors, design of enzyme electrodes;

Unit 5:
Biological applications of enzymes
Enzyme utilization in food and drink industry, pharmaceutical: Assay of plasma enzymes, Enzymes of inborn errors of metabolism, Enzymes as reagent in clinical chemistry. Applications of enzymes in biotechnology & agricultural industries , Application of enzymes in recombinant DNA technology , Enzymes and bioinformatics.

References

1. Donald Voet, Judith G. Voet, 'Fundamentals of Biochemistry', John Wiley & Sons, INC (2006) Publication, 2nd Edition.
2. John W Baynes, Marek H. Dominiczak, 'Medical Biochemistry', Elsevier Mosbey Publication.

BT-A-III-3 – Reaction Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction: Reaction rate, Type of reactions, Homogenous, and Heterogeneous reactions. Kinetics of Homogenous Reaction: Simple reversible and irreversible reaction, Single and parallel reactions, Effects of concentration and temperature on reaction rate, Arrhenius equations, Transition- state and collision theory.

Unit 2:
Interpretation of Reactor Data: Data procurement and analysis, Constant volume and Varying volume Batch Reactor, Integral, and differential methods of analysis for various types of reactions

Unit 3:
Designs fundamentals and behavior of Isothermal reactor: Performance equation for Ideal Batch Reactor, Space Time and Space Velocity, Performance equation for Mixed flow reactor and Plug flow reactor, Size comparison for single reaction, Multiple reactors, Mixed flow reactors in series, Recycle Reactors, Auto catalytic reactions, Design for parallel reactions, Multiple reactions in series and series-parallel combinations reactions, fractional yield.

Unit 4:
Temperature and Pressure Effects: Single and multiple reactions. RDT theory and its application to reactor design; Interphase and intraparticle mass and heat transfer effects in catalyst particle during reaction;

Unit 5:
Catalyst de-activation; Introduction to design of heterogeneous reactors. Fluid particle reactions: Models, Determination for the rate-controlling step, Type of contacting.

Group-B-I:

BT-B-I-1 – Vaccine Biotechnology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction and history of Vaccine, Vaccine Immunization, Active and Passive immunization, Immune response and its detection

Unit 2:
Designing of vaccines, Preservation of vaccines, Method of doing vaccination and dosage, Concept of Antigen and Antibody, Antigen –Antibody reactions

Unit 3:
Live Vaccines, attenuated Vaccines and killed vaccines, Recombinant DNA vaccines, Subunit vaccines, Conjugate Vaccines and Peptide Vaccines.

Unit 4:
Viral Vaccine-Vaccinia, Polio, Hepatitis B, Influenza and HIV;
Bacterial Vaccine -Pertusis, Cholera vaccine, Tetanus, BCG Vaccine

Unit 5:
Manufacturing and quality assurance, cost benefit and cost effectiveness; Regulation, testing and safety of vaccines

References

1. Kuby, ‘Immunology’, W. H. Freeman & Company, New York.
2. Singh B.D., ‘Text Book of Biotechnology’.

BT-B-I-2 – Drug Designing

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Drug target classification: DNA, RNA, post-translational processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors, small molecule receptors, transporters;

Unit 2:
Target discovery and validation strategies: genomics, natural products, combinatorial chemistry, general overview of modeling methodologies, structure based drug design, protein structure determination and alternative techniques;

Unit 3:
Structure based design: 'de novo' design methodologies, receptor mapping, 3D database searching techniques;

Unit 4:
Design and development of combinatorial libraries for new lead generation: the molecular diversity problem, characterization, chemiometrics in drug design;

Unit 5:
QSAR: statistical techniques behind QSAR, drug metabolism, toxicity and pharmacokinetics.

References

1. Richard S. Larson. 'Bioinformatics and Drug Discovery', Humana Press, Totowa, New Jersey.
2. Mannhold R., Kubinyi H., Timmerman H. , 'Bioinformatics From Genomes to Drugs (Volume I&II), Wiley – VCH Publication.

BT-B-I-3 – Transfer Processing I

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Review of convective heat transfer relations; Heat exchanger types; Selection and rating calculation for double pipe exchanger - Parallel and counter-current flows.

Unit 2:
Shell and Tube Heat exchangers, LMTD, Equivalent diameter; Concept of NTU method, Effectiveness, Fouling factors, Cross flow heat exchangers and it's application, Design of Shell and Tube Heat Exchangers, Calculation of heat transfer coefficient and pressure drop.

Unit 3:
Condensation and boiling phenomena, Condensation of single vapors system, type of condenser. Evaporators, Classification and process calculations including multiple effect evaporators, BPR, Forward and Backward feeds

Unit 4:
Vaporizers, Forced and Natural circulation vaporizers, Radiation laws and calculations of radioactive heat transfer, Exchange of energy between two surfaces-Large plates, Infinites cylinders, Geometric factors.

Unit 5:
Cold and hot insulations; Critical radius, Crystallization mechanism and types of crystallizers and their operation.

Group-B-II:

BT-B-II-1 – Biological NMR

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Principles of Nuclear Magnetic Resonance (NMR), Chemical Shift; Spin-Spin coupling and Relaxation times (T1 and T2), Nuclear Overhauser Effect (NOE) experiments;

Unit 2:
2D NMR methods – COSY, NOSY, TOCSY, ROESY etc;

Unit 3:
Peptide and Protein structure; Protein folding studies; Enzyme structure;

Unit 4:
Nucleic Acids; Protein- DNA interaction; Polysaccharides; Membrane structure and fluidity;

Unit 5:
Magnetic Resonance Imaging (MRI): Basic introduction, Image formation; Scanner construction and operation: Magnet, RF system, Gradients, Contrast enhancement; Different applications of MRI.

References

1. Wilson K. and Walker J.(2006).'Principles and Techniques of Biochemistry and Molecular Biology'. Cambridge University Press, 6th Edition.
2. Philip E. Bourne, Heldge Weissig, 'Structural Bioinformatics', A John Wiley & Sons Publication.
3. Donald Voet, Judith G. Voet, 'Fundamentals of Biochemistry', John Wiley & Sons, INC (2006) Publication, 2nd Edition.

BT-B-II-2 – Bioreactor Design & Analysis

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Bioreactors Introduction, types of bioreactor.Ideal bioreactors: CSTR, Plug Flow, Fed batch, Stirred tank reactors with recycle and wall growth.

Unit 2:
Non-ideal reactor; Basic models for non – ideal reactors,Heat transfer effects in bioreactor; reactor dynamics: stability analysis: packed Bed.

Unit 3:
Bubble- column, Fluidized bed, Trickle bed, Photo bioreactor, Design and operation of aseptic conditions in bioreactor.

Unit 4:
Aerobic and anaerobic fermentation process, Different methods of fermentaion; Alternative bioreactor configuration; Shear effects in bioreactor.

Unit 5:
Animal plant cell cultivation techniques – Sources of cells, cell bank, Techniques of cell culture, the substrate on which cells grow in Laboratory, Media handling Equipment, Cell culture media, animal tissue culture media, Preparation of material.

References

1. Crueger and Crueger, ‘ Biotechnology’ Panima Publishing Corporation, New Delhi.
2. Patel A.H., ‘Industrial Microbiology’, MacMillian India Ltd.

BT-B-II-3 – Transfer Processing II

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Gas Absorption; equalizing solubility of gas in liquid; Driving mechanism and various separation processes; Ideal stage; Single multistage operation for different flow patterns; Multi stream systems; Simplified calculation methods for staged operation including analytical and graphical techniques;Unsteady state staged operation concept of NTU and HTU in mass transfer units, such dehumidifiers and dryers

Group-B-III

BT-B-III-1 – Diagnostics

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to medical Biotechnology; immunodiagnostic procedures; Monoclonal antibodies and its medical application

Unit 2:
HLA Typing; DNA diagnostic systems; hybridization probes; Diagnosis of malaria and other diseases, non-isotopic hybridization procedures, in situ hybridization ; Molecular beacons and oligoriboprobes, ribozymes

Unit 3:
Diagnosis of genetic diseases; Detection of mutation in DNA, DNA amplification and quantification, PCR/OLA procedures.

Unit 4:
Molecular markers and DNA polymorphism, DNA finger printing

Unit 5:
Bioinformatics and molecular diagnostics; Biosensor detection technology.

References

1. Prescott, Harley and Klein, ‘ Microbiology’, MC Graw Hill, International Edition.
2. James D. Watson , Michael Gilman, ‘ Recombinant DNA’, W. H. Freeman & Company, New York.
Brown T.A., ‘ Genomes 3’, Garlend Science Publishing

BT-B-III-2 – Bimolecular Modeling

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Computational mechanics- Molecular orbital calculations; Molecular mechanics; Empirical potentials (CFF, AMBER, CHARMM etc);

Unit 2:
Energy minimization and convergence criteria; Computer simulation methods;

Unit 3:
Molecular dynamics and simulated annealing: Newtonian and Hamiltonian dynamics; Phase-space trajectories, Fundamental distributions, Periodic boundary conditions, Conservation principles; Dynamic properties; Time correlation functions, Transport coefficients, Static and dynamic structure; Thermodynamic response functions; Monte Carlo Techniques.

Unit 4:
Conformational analysis by Distance Geometry (DG); Restrained Molecular Dynamics (RMD);

Unit 5:
Software: MOE, XPLOR, DISCOVER, etc.

References

1. Leimkuhler B. and Chipot C. 'New Algorithms For Macromolecular Simulation' Springer Publication.
2. Schlick Tamar 'Molecular Modeling & Simulation, Springer Publication

BT-B-III-3 – Cell & Tissue Engineering

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to tissue engineering:
Cell Therapies. Tissue Constructs, Organ Modules, Cosmetic Measures. Concepts of Tissue Creation**:** Sources, Stem Cells, Cells from Tissues, Culture Methods for Tissue Engineering. Maturation of Tissue Constructs. Musculo–skeletal tissue engineering; Modifications of tissue ring; Receptors ligand interaction; Receptor.

Unit 2:
Biomaterials for tissue engineering:
Biomaterials: Degradable polymeric scaffolds, Acellular Bio- Matrices, Biological derived polymers in tissue engineering: Natural BD Polymers & Synthetic BD polymers, Cell seeding of scaffolds, Cell source: Allogenic cells, Autologous cells & stem cells**.** Bioreactors used in tissue engineering: Nail Naughtom's Bioreactor, Pulsatile Bioreactor
Unit 3:
Biological study of different cell types:
Cell line, Establishment of cell lines, Different cell types: Endothelial cell, Fibroblast cells, Epithelial cell, Myoblast cells, chromaffin cell, Smooth muscle cells & plasma cell.

Unit 4:
Principles and practice gene therapy:
Introduction to gene therapy, Requirements of gene therapy, Genetic defects, Target cells for gene therapy, process of gene therapy , Factors responsible for gene therapy for making effective treatment of genetic disease, Recent developments in gene therapy research, ethical considerations of gene therapy.

Unit 5:
Development of artificial tissues; Transplantation biology: Tissue typing, Techniques of tissue typing, Minor histocompatibility antigens, Immuno-suppression, Side effects of immuno-suppression

References

1. S. S. Bhojwani, M. K. Razdan, 'Plant Tissue Culture (Theory and Practice), North Holland.
2. M. M. Ranga , ' Animal Biotechnology ', 2nd Edition, Agrobios (India) .
3. James D. Watson , Michael Gilman, ' Recombinant DNA' ,Scientific American Books.

Group-B-IV

BT-B-IV-1 – Nanobiotechnology

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction to Nanobiotechnology, Brief History of Polymer Coated Iron Oxide Nanoparticles, Biocompatible Inorganic Devices biological problems

Unit 2:
Nanocrystals in biological Detection; Potential for Nanobiotechnology Biofunctionalized Nanoparticles for Surface-Enhanced Raman Scattering and Surface Plasmon Resonance; protein based Nanocrystals- Nano-Patterning of Protein and Petides Using DPN

Unit 3:
Microbial nanoparticle production-Magnetosomes: Nanoscale Magnetic Iron Minerals in Bacteria, Bacteriorhodopsin and its Potential in Technical.

Unit 4:
DNA based nanostructures DNA-Protein Nanostructures , DNA-templated Electronics , Biomimetic Fabrication of DNA-based Metallic Nanowires and Networks , Mineralization in Nanostructured Biocompartments: Biomimetic Ferritins for High-Density Data Storage , DNA–gold-Nanoparticle Conjugates , DNA Nanostructures for Mechanics and Computing: Nonlinear Thinking with Life's Central Molecule, Nanoparticles as Non-Viral Transfection Agents and Gold nanoparticle conjugates - Bioconjucated Silica Nanoparticles for Bioanalytical Applications; Luminescent quantum dots for biological imaging .

Unit 5:
Emerging Nanobiotechnologies: nano labels- Nanoparticle Molecular Labels, biosensors-Classes of Biosensors, Catalytic and Affinity Biosensors Fabricated using Supported, Membrane Biosensors Based on Ion Channel Gating, Membrane Biosensors Based on Ion Channel Gating Biomimetic Membranes for Biosensor Applications, Membrane Biosensors Based on Ion Channel Gating, Nanofabrication, medicine-Potential Biomedical Applications of Polymer Nanostructures.

Reference:

1. Charles P. Poole, Jr., Frank J. Owens; “Introduction to Nanotechnology”, John Wiley& Sons, 2003,
2. K.K. Jain Publisher: Taylor & Francis “Nanobiotechnology Molecular Diagnostics: Current Techniques and Applications (Horizon Bioscience)” (Hardcover), 1 edition (March 1, 2006).

BT-B-IV-2 – Digital Signal Processing

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Unit 1:
Introduction-Signal system, and signal processing, Classification of signals, the concept of frequency in Continuous - Time and Discrete- Time signals.

Unit 2:
Discreet Time Signal and Systems - Analysis of Discrete- Time, Linear Time- Invariant Systems, Recursive and non recursive Discrete Time signals. Correlation of Discrete-Time signals

Unit 3:
The Laplace Transform and Z-Transform. - Introduction of L-transform and Z-transform, Region of Convergence, Inverse Transform of L-Transform and Z-Transform

Unit 4:
The Discrete Fourier Transform-Frequency Domain Sampling: DFT, Properties of DFT, Linear Filtering methods based on DFT.

Unit 5:
Design of Digital Filter.- General consideration, design of FIR filter, Design of IIR filters from analog filters. Design of Digital filter

Reference:

1. Prokis –Manolakis: Digital Signal Processing, Prentic-Hall India, 2004
2. Oppenheim- willsky: Signal and Systems, Prentic-Hall India, 2004

BT-B-IV-3 – Industrial Instrumentation

(L: 3: T: 1) **Max.Marks:100**
Min.Marks:35

Measurement and its classification; Static characteristic of instruments; Interpretation of performance specification of transducers; Sensor and transducer classification; Building block of instruments; Process instrumentation working principle of transducer/instruments. Various types of instrumentation. Preparation of instrumentation diagram; Instrumentation of process equipment like distillation column, heat exchanger, etc