ANNAMALAI UNIVERSITY
DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY
M.Sc. BIOTECHNOLOGY
(Five Year Integrated Programme)
(Choice Based Credit System)
REGULATIONS AND SYLLABUS
(2013–2014)
REGULATIONS

Common to all Departments of Studies in the Faculty of Science

Master’s Programme
A Master’s Programme consists of a number of courses, in M.Sc. A Master’s Programme consists of a set of compulsory courses and Language Papers.

The entire course carries credit system. The number and distribution of credits for the courses will be decided by the respective faculties.

A Course is divided into two Semesters, Odd Semester and Even Semester.

Credits
The term credit is used to describe the quantum of syllabus for various programs in terms and hours of study. It indicates differential weightage given according to the contents and duration of the courses in the Curriculum design.

The minimum credit requirement for the award of the Degree of Five Years Master’s Programme shall be 154.

Courses
Each course may consist of Lectures/Tutorials/Laboratory work/Seminar/Project work/Practical training report/Viva voce etc.

Normally, in each of the courses, credits will be assigned on the basis of the Lectures/Tutorials/Laboratory work and other form of learning in a 18 week schedule.

Eligibility for Admission
Candidates for admission to the first year of the Five Year Integrated M.Sc. Degree Courses shall be required to have passed the final examination of the Plus 2 Higher Secondary Course and Equivalent thereto with a minimum of 50% aggregate under academic stream with the following subjects conducted by the Board of Secondary Education, Tamil Nadu Government or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto.

<table>
<thead>
<tr>
<th>M.Sc.(Biotechnology)</th>
<th>A pass in H.Sc. (10+2 level) OR Equivalent thereto with a minimum aggregate of 40% marks under academic stream in the following subjects viz.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Physics, Chemistry &amp; Mathematics</td>
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<tr>
<td></td>
<td>2. Physics, Chemistry &amp; Biology</td>
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<tr>
<td></td>
<td>3. Physics, Chemistry &amp; Botany</td>
</tr>
<tr>
<td></td>
<td>4. Physics, Chemistry &amp; Zoology</td>
</tr>
<tr>
<td></td>
<td>5. Physics, Chemistry &amp; Biochemistry</td>
</tr>
</tbody>
</table>

They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Grading System

The term grading system indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

Course Duration

The duration for completion of a Five Year Integrated M.Sc. Programme in any course is Ten Semesters.

Student Counsellors

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study.

Attendance

Every teaching faculty handling a course shall be responsible for the maintenance of Attendance Register for candidates who have registered for the course.

The instructor of the course must intimate the Head of the Department at least Seven Calender days before the last instruction day in the semester about the particulars of all students who have secured an attendance of less than 80%.

A candidate who has attendance less than 80% shall not be permitted to sit for the End-Semester Examination in the course in which the shortage exists.

However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 80% attendance for valid reasons on payment of a condonation fee and such exemptions should not under any circumstances be granted for attendance below 70%.

Examination

There will be two sessional assessments and one End-Semester Examination during each semester.

Sessional Test-I will be held during Sixth Week for the syllabi covered till then.

Sessional Test-I will be a combination of a variety of tools such as class test, assignment and paper presentation that would be suitable to the course. This requires an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test-I may be for one hour duration. The pattern of question paper will be decided by the respective Faculty. Sessional Test-I will carry 20% of marks of the entire course.

Sessional Test-II will be conducted with a variety of assessment tools. It will also have an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test II may be for two hours’ duration. The pattern of question paper will be decided by the respective Faculty. Sessional Test-II will carry 20% of marks of the entire course.
There will be one End Semester Examination of 3 hours duration in each course.

The end semester Examination will cover all the syllabus of the course for 60% of marks.

**Evaluation**

Evaluation will be done on a continuous basis. Evaluation may be by Objective Type Questions, Quiz, Short Answers, Essays or a combination of these, but at the End Semester it has to be a Written Examination.

The performance of students in each course is evaluated in terms of percentage of marks (PM) with a provision for conversion to Grade Point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance from the 2nd Semester onwards will be marked by (OGPA).

**Marks and Grading**

A student cannot repeat the assessment of Sessional Test-I and Sessional Test-II. However, if for any compulsive reason the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A minimum of 50% marks in each course is prescribed for a pass. A student has to secure 50% minimum in the End Semester Examination. A candidate who has not secured a minimum of 50% of marks in a course shall be deemed to have failed in that course.

The student can repeat the End Semester Examination when it is offered next in the subsequent Odd/Even Semesters till the regulations are in force. However, a candidate cannot move to the next odd/even semester if he/she has more than six papers as arrears at any point of time.

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned a minimum of the credits will be considered to have passed the Master’s Programme.

**Grading**

A ten point rating is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master’s Programme.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Grade Points</th>
<th>Letter Grade</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>90+</td>
<td>10</td>
<td>S</td>
<td>Exemplary</td>
</tr>
<tr>
<td>85 – 89</td>
<td>9.0</td>
<td>D++</td>
<td>Distinction</td>
</tr>
<tr>
<td>80 – 84</td>
<td>8.5</td>
<td>D+</td>
<td>Distinction</td>
</tr>
<tr>
<td>75 – 79</td>
<td>8.0</td>
<td>D</td>
<td>Distinction</td>
</tr>
<tr>
<td>70 – 74</td>
<td>7.5</td>
<td>A++</td>
<td>First Class</td>
</tr>
<tr>
<td>65 – 69</td>
<td>7.0</td>
<td>A+</td>
<td>First Class</td>
</tr>
<tr>
<td>60 – 64</td>
<td>6.5</td>
<td>A</td>
<td>First Class</td>
</tr>
<tr>
<td>55 – 59</td>
<td>6.0</td>
<td>B</td>
<td>Second Class</td>
</tr>
<tr>
<td>50 – 54</td>
<td>5.5</td>
<td>C</td>
<td>Second Class</td>
</tr>
<tr>
<td>49 or Less</td>
<td>F</td>
<td>Fail</td>
<td></td>
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</tbody>
</table>
The successful candidates in the Core Subjects are classified as follows.

I – Class 60% marks and above in overall percentage of marks (OPM).
II – Class 50–59% marks in overall percentage of marks.

Candidates who obtain 75% and above but below 90% of marks (OPM) shall be deemed to have passed the examination in First Class(Distinction) provided he/she passes all the course prescribed for the programme at the first appearance.

Candidates who obtain 90% and above (OPM) shall be deemed to have passed the examination in First Class (Exemplary) provided he/she passes all the courses prescribed for the programme at the first appearance.

Candidates who obtain highest marks in all examinations at the first appearance alone will be considered for ranking.

For the Internal Assessment Evaluation the break up marks shall be as follows:

- Test (15 + 15) : 30 marks
- Assignment : 05 marks
- Case Study/Seminar/Short Answers etc. : 05 marks
- Total : 40 Marks

Course – Wise Letter Grades

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

A student is considered to have completed a course successfully and earned the credits if he/she secures overall grades other than F. A letter grade F in any course implies a failure in that course. A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

The F Grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

If a student secures F grade in the Project Work/ FieldWork / PracticalWork / Dissertation, either he/she shall improve it and resubmit it if it involves only rewriting incorporating the clarification of the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

Transitory Regulations

Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.
# SCHEME OF EXAMINATIONS

**FIRST SEMESTER**  
Total Credits : 159

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITAC 11</td>
<td>Language–I</td>
<td>75+25</td>
<td>3</td>
</tr>
<tr>
<td>IENC 12</td>
<td>English–I</td>
<td>75+25</td>
<td>3</td>
</tr>
<tr>
<td>ICEC 13</td>
<td>Civics, Environmental Awareness and Health Science</td>
<td>75+25</td>
<td>3</td>
</tr>
<tr>
<td>IBTT 14</td>
<td>Bioorganic Chemistry</td>
<td>75+25</td>
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**SECOND SEMESTER**

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<tbody>
<tr>
<td>ITAC 21</td>
<td>Language–II</td>
<td>75+25</td>
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<tr>
<td>IENC 22</td>
<td>English–II</td>
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<tr>
<td>ICAC 23</td>
<td>Computer Applications–I</td>
<td>75+25</td>
<td>3</td>
</tr>
<tr>
<td>IBTT 24</td>
<td>Biomolecules</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTP 25</td>
<td>Practicals in Biomolecules</td>
<td>75+25</td>
<td>1</td>
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<td></td>
<td><strong>TOTAL</strong></td>
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**THIRD SEMESTER**

<table>
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<tr>
<td>ICAC 31</td>
<td>Computer Applications–II</td>
<td>75+25</td>
<td>3</td>
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<tr>
<td>IBTT 32</td>
<td>Plant Science</td>
<td>75+25</td>
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<tr>
<td>IBTT 33</td>
<td>Animal Science</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTT 34</td>
<td>Biophysical Chemistry</td>
<td>75+25</td>
<td>4</td>
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**FOURTH SEMESTER**

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<tbody>
<tr>
<td>IBTT 41</td>
<td>Proteins and Nucleic Acids</td>
<td>75+25</td>
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<tr>
<td>IBTT 42</td>
<td>Analytical Techniques</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTT 43</td>
<td>Enzyme Technology</td>
<td>75+25</td>
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</tr>
<tr>
<td>IBTP 44</td>
<td>Practicals in Proteins, Nucleic Acids and Analytical Techniques</td>
<td>75+25</td>
<td>2</td>
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<tr>
<td>IBTP 45</td>
<td>Practicals in Enzyme Technology</td>
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**FIFTH SEMESTER**

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<tr>
<td>IBTT 51</td>
<td>Metabolism and Regulation</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTT 52</td>
<td>Molecular Cell Biology</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTT 53</td>
<td>Microbiology</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTT 54</td>
<td>Biostatistics</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
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### SIXTH SEMESTER

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<tbody>
<tr>
<td>IBTT 61</td>
<td>Molecular Biology–I</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTT 62</td>
<td>Immunology and Immunotechnolgy</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTT 63</td>
<td>Food Technology</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTP 64</td>
<td>Practicals in Cell and Molecular Biology</td>
<td>75+25</td>
<td>2</td>
</tr>
<tr>
<td>IBTP 65</td>
<td>Practicals in Microbiology, Immunology and Food Technology</td>
<td>75+25</td>
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<td></td>
<td><strong>TOTAL</strong></td>
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### SEVENTH SEMESTER

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<tbody>
<tr>
<td>IBTT 71</td>
<td>Molecular Biology–II</td>
<td>75+25</td>
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<tr>
<td>IBTT 72</td>
<td>Bioprocess Engineering and Downstream Processing</td>
<td>75+25</td>
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<tr>
<td>IBTT 73</td>
<td>Environmental Biotechnology</td>
<td>75+25</td>
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<tr>
<td>IBTT 74</td>
<td>Marine Biotechnology</td>
<td>75+25</td>
<td>4</td>
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<tr>
<td>IBTP 75</td>
<td>Practicals in Bioprocess Engineering, Downstream Processing and Environmental Biotechnology</td>
<td>75+25</td>
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<tr>
<td>IBTP 76</td>
<td>Practicals in Marine Biotechnology</td>
<td>75+25</td>
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<td><strong>TOTAL</strong></td>
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### EIGHTH SEMESTER

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<tr>
<td>IBTT 81</td>
<td>Genetic Engineering</td>
<td>75+25</td>
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<tr>
<td>IBTT 82</td>
<td>Plant Biotechnology</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTT 83</td>
<td>Animal Biotechnology</td>
<td>75+25</td>
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<tr>
<td>IBTP 84</td>
<td>Practicals in Genetic Engineering</td>
<td>75+25</td>
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### NINTH SEMESTER

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<tbody>
<tr>
<td>IBTT 91</td>
<td>Genomics</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTT 92</td>
<td>Proteomics</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTT 93</td>
<td>Bioinformatics</td>
<td>75+25</td>
<td>5</td>
</tr>
<tr>
<td>IBTT 94</td>
<td>Drug Design and Drug Action</td>
<td>75+25</td>
<td>5</td>
</tr>
<tr>
<td>IBTP 95</td>
<td>Practicals in Bioinformatics</td>
<td>75+25</td>
<td>4</td>
</tr>
<tr>
<td>IBTP 96</td>
<td>Practicals in Plant and Animal Biotechnology</td>
<td>75+25</td>
<td>2</td>
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<td><strong>TOTAL</strong></td>
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### TENTH SEMESTER

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<tr>
<td>IBTT 101</td>
<td>Medical Biotechnology (OR)</td>
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<tr>
<td>IBTPJ 102</td>
<td>Project</td>
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SYLLABUS
FIRST SEMESTER
ITAC 11

myF – 1
FWe;bjhifg; ghly;fs;/
(vz;fs; 2. 3. 40 .44. 54. 57. 69. 135. 167. 197).

myF – 2
g[wehD}w;Wg; ghly;fs;/
(vz;fs; 47. 86. 112. 163. 182. 184. 192. 235. 239).

myF – 3
jpUf;Fws; – fy,tp; fy;yhik mjpfhu';fs;/

myF – 4
fk;guhkazk; – Re;ju fhz;lk; – fhl;rg; glyk;/

myF – 5
g[ul;rpf;ftp – ghujpjhrd;/
ciueil – fk;gh; – lhf;lh; t/ Rg/ khzpf;fk;/

IENC 12: ENGLISH – I

Unit–I: Superstition and Magic Young People

Listening:
1. In some Tamil Nadu villages People Shun Umbrellas During the Rains.
2. Money Matters Most for Today’s Youth

Reading: Text A: Superstition is a Belief, Half Belief
Text B: Night of the Scorpion
Text C: Genuine East Indian Magic
Text D: The Young Ones
Text E: The Home Coming

Writing: 1. A Spiritualist’s Bluff
2. The Mother Daughter Relationship I & II

Grammar: The passive, Indirect Speech

Speaking: Global Questions.

Unit–II: Food and Health Indian Films

Listening: 1. Animal or Vegetable?
2. Problems of a Bengal Film Maker

Reading: Text A: Tea or Coffee
Text B: Choice of Crops for Improved Nutrition
Text C: The Luncheon
Text D: On Top of the World
Text E: Corrosive Rhythms

Writing: 1. Take Care: Cigarettes
2. A Film Review

Grammar: Modal Auxiliaries, Simple Past and Past Progressive, Past Perfect
Speaking: Global Questions

Unit–III : Urban and Rural Life Advertising

Listening: 1. A Frightening Scenario
2. A: The Royal Parks of London
   B: Richmond Park Can Be a Very Big Place if You're Only Three Feet Tall

Reading: Text A: Urban Villagers
         Text B: We Die Together
         Text C: Henchard’s Oath
         Text D: Ode on Solitude
         Text E: Age of virtuous Ad
         Text F: Code of Ethics for Advertising

Writing: 1. Psyches Crumble as Bombayites Fight Stress
2. Visual Writing

Grammar: Prepositions of Phrasal Verbs, Conditional Sentences
Speaking: Global Questions

Unit–IV : Environment Women in India

Listening: 1. Industrialist's Recipe for money
2. Famous Indian Women: A. M.S. Subbulakshmi
   B. Kiran Bedi

Reading: Text A: Noise – Global Perspective
         Text B: Earthworm
         Text C: Science for Man, Not Nations
         Text D: Relationships
         Text E: Talking Runs!
         Text F: Indian Women

Writing: 1. Eco-friendly Disposal of Waste Paper
2. Women and Men Do Think Differently
3. Bihar Parties’ High-pitched Drive to Woo Women
Grammar: Present Perfect and Present Progressive, Stative and Dynamic Verbs, Articles
Speaking: Global Questions

Unit–V : Famous People English in the World
Listening: 1. My Finesh Hour
2. British and American English – Part I & II
Reading: Text A: Habba Khatooon
Text B: ... And Allah Created Lata
Text C: Vinoba Bhave
Text D: A Psalm of Life
Text E: How Indians Use English
Text F: What is Your Good Name, Please?
Text G: Meeting Friends
Writing: 1. My Sixteenth Year
2. Marriage Lines
Grammar: Concord, Features of Indian English
Speaking: Global Questions

References

ICEC 13 : CIVICS, ENVIRONMENTAL AWARENESS AND HEALTH SCIENCE

(A) CIVICS

Unit–I : Introduction

Unit–II : Political System

Books recommended
3) R.C. Agarwal, Indian Political System, New Delhi, S.Chand & Company, 2000.

**B) ENVIRONMENTAL SCIENCES**

**Unit–I : Ecosystems**


**Unit–II : Environment**


**References**


**C) HEALTH SCIENCES**

**Unit–I**

Physical Health – Introduction to health – Food, meaning of balanced diet, Sources, Common nutritional deficiencies and prevention.

Personal Health – Cleanliness of body, Care of Skin, Nails, Eye, Hair, Oral Health, Clothing, Body posture and good habits such as exercises – Importance of avoiding smoking, alcoholism, drugs etc.,

Population explosion and Family Planning – Importance, Common methods of family planning for Men & Women.

Mothers and Children – Immunisation of Children (importance, Schedule) care of mothers during pregnancy and after delivery.

Communicable Diseases – Symptoms and prevention.

**Unit–II**

References

IBTT 14 : BIOORGANIC CHEMISTRY

Unit–I : Atomic Structure

Unit–II : Chemical Bonding
Molecular orbitals, hybridization of atomic orbitals. sp³, sp² and sp hybridization. Quadrivalency of carbon, formation of CH₄, NH₃, H₂O, CH₂=CH₂ and acetylene molecules. Formation of σ and π bonds. Shapes of the above – mentioned molecules. Polar nature of covalent bonds, attractive forces between molecules, van der Waals’ forces, dipole interactions and hydrogen bond.

Unit–III : Basic Organic Chemistry

Unit–IV : Isomerism 1
Isomerism in organic compounds. Types of isomerisms, Tautomerism with special reference to purines.

Unit–V : Isomerism 2
**Books Recommended**


**SECOND SEMESTER**

ITAC 21: gad;ghl;Lj; jkpH;

myF−1  
\[ \text{ey;yjkphpy; vGJtJ vgo> } \]
\[ \text{rpy jkpHhl;rpr; brhw;fs; typ kpFjy;−1 − typ kpFjy;−2. typ kpFjYk; kpfhika[k; – typkpFk; tpjfpspd; bjhfGg;gL − typkpfhikf;Fhpa tpjp − vspa rf;jp tpjfps; − rpy re;jp Kiwfs; − ghE}y;fs; \]
\[ \text{ey;y jkpH; vGj ntz:Lkh}> m/fp/gue;jhkdhh; – ghhp epiyak; – brd;id/} \]

myF−2  
\[ \text{brhw;bwih;g;gphpg;gL; jtWfs; − thf;fpa tiffSk; mikf;Fk; Kiwfsk; – thf;fpa mikg;gpy; mwpa ntz:LTd − thf;fpa thf;f;fSk; jpUj;j';fSk; − rpy ,dpa thf;fpa';fs; − gj;jpaikg;gL − epWj;jf; Fwpfsk; jtwFs; − fl;Liu vGJjy; − ciuelapy; ftdpf;f ntz:Ltd − ghE}y; − ey;y jkpH; vGj ntz:Lkh> m/fp/gue;jhkdhh; – ghhp epiyak; – brd;id/} \]

myF−3  
\[ \text{ghE}y; − fiyr; brhy; Mf;fk; − lhf;lh; ,uhjh/ bry;yg;gd;/} \]

myF−4  
\[ \text{nkilj;jkpH;} / \]
\[ \text{ghE}y; − eP';fSk; ngr;rshuhfhyhk; − Fkhp mde;jd; − g{k;gLhh; gpuRuk; − brd;id/} \]

myF−5  
\[ \text{JHpay; tHf fl;Liu vGJjy; /} \]
\[ \text{ghE}y; − rpe;jidr; nrhiy − jlj;jpU fD;wf;Fo mofshh; fylthzp gLj;jfhya; − brd;id−17.}
IENC 22 : ENGLISH – II

Unit–I
Spoken English: Practice in the correct pronunciation of English vowels and consonants, syllables, and accent.

Unit–II
Written Communication: vocabulary development, word structure, word structure, word order, and phrasal verbs.

Unit–III
Comprehension: Listening and Reading Comprehension.

Unit–IV
Composition: paragraph writing, precis writing, dicto composition, letter writing, writing a term paper, writing book reviews.

Unit–V
Essentials of Grammar: Remedial exercises in parts of speech, structure of sentences, sequence of tenses, use of articles, and modes of reporting.

In addition to these components, students would be involved in performing communicative tasks such as making short speeches, interpreting visual presentations, role play, and group discussions.

References

ICAC 23 : COMPUTER APPLICATIONS I

Unit–I


Unit–II


Unit–III

Fundamentals of HTML, TCP/IP and E-commerce.
Unit–IV
Issues involved in Web Site Management – Addressing – Designing Web Sites with Front Page.

Unit–V

Using Multimedia: Multimedia Interface, Planning and Development of Multimedia projects.

Books Recommended
1) Ron Mansfield, Osborne, Windows 95 for Busy People, McGraw Hill.
2) Ron White, How computers work, BPB.
3) Christian Crumlish – The ABCs of the Internet.

References
4) James Meade, Davind Growder, Rhonda Growder – Microsoft DHTML.

IBTT 24 : BIOMOLECULES

Unit–I : Introduction to Macromolecules


Unit–II : Carbohydrates
Classification and properties. Biologically important monosaccharides – structure and stereoisomeric forms. Pentoses, glucosides, deoxysugars and amino

**Unit–III : Glycoconjugates**


**Unit–IV : Lipids**


Molecular organization of cell membrane – membrane proteins and lipids. The fluid mosaic model.

**Unit–V : Vitamins**

Fat – soluble vitamins – structure, sources, requirements, biological actions and clinical significance of vitamins A, D, E and K.

Water – soluble vitamins – structure, sources, requirements, biological actions and clinical significance of thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, biotin, folic acid and vitamin B₁₂.

**Books Recommended**

IBTP 25 : PRACTICALS IN BIOMOLECULES

2. Preparation of buffers.
3. Comparison of capacities of two buffers of same pH.
4. Qualitative analysis of amino acids.
5. Quantitative estimation of amino acids by ninhydrin method.
6. Qualitative analysis of carbohydrates.
8. Isolation of starch from potato.
9. Qualitative analysis of lipids.
10. Determination of acid number of a fat.
11. Determination of iodine number.
12. Determination of saponification value.

THIRD SEMESTER
ICAC 31 : COMPUTER APPLICATIONS – II

Unit–I
Introduction to Microsoft Office – Create and Modify Documents – Format the Text, Tables within the Documents – Merge the Documents and Print – Working with World Wide Web.

Unit–II

Unit–III
Concept of data types, field, record, table and Data Base – creation – modification – manipulation – backup and recovery – significance and need of Queries.

Unit–IV
Importance of the Primary Key – Foreign Keys and Lookup Lists – Significance of Data Validation – Input Mask – Sorting and Indexing – Use Table Relationships and Forms – Application – Reports – creation and printing.
**Unit–V**
Create and Modify Presentations – Create Master slide and templates – Different Views of Slide – Add animation and Transitions.

**Books Recommended**

**References**

**IBTT 32 : PLANT SCIENCE**

**Unit–I : Plant Diversity–I**
Classification of algae, Fungi and Bryophytes. Structure, reproduction and life history of Algae (Sargassum & Spirulina), Fungi (Yeast & Agaricus) and Bryophytes (Riccia & Funaria).

**Unit–II : Plant Diversity–II**
Classification of Pteridophytes and Gymnosperms. Structure, reproduction and life history of Pteridophytes (Lycopodium & Pteris) and gymnosperms (Pinus & Ephdra).

**Unit–III : Taxonomy of Angiosperms, Economic Botany and Plant Breeding**
Classification and General characters of Angiosperms (Bentham & Hooker), Binomial and its regulation.
A general account of Economic Botany, cultivation and utilization of plants for food, and medicine.
Hybridization – Intergeneric, interspecific and intervarietal. Hybrid vigour and utilization.

**Unit–IV : Angiosperm Anatomy & Embryology**
Structure of leaf, stem and root of dicots and monocots.
Structure of flower, Microsporogenesis, Megasporogenesis and gametogenesis. Endosperm and Embryo Development.

**Unit–V : Plant Physiology and Ecology**
Water and plant relations: Absorption and Translocation of solutes Mechanism of stomatal opening and closing.
Food chain, food web and ecological pyramids. Ecological indicators.
Books Recommended


IBTT 33 : ANIMAL SCIENCE

Unit–I
Characteristic features and classification (upto order level) of major Invertebrate and Vertebrate phyla. (Protozoa, Porifera, Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca and Echinodermata, Protochordata, Fishes, Amphibia, Reptiles, Birds, Mammals).

Unit–II
Arthropods and vectors of human diseases (mosquitoes, lice, flies and ticks). Mode of transmission of pathogens by vectors; control measures of arthropod vectors. Biology and control of chief insect pests of agricultural importance (paddy, sugarcane, and cotton); Useful insects: silkworm.

Unit–III
Gametogenesis in animals. Molecular events during fertilization. Cleavage patterns and fate maps – concepts of determination, competence and induction, totipotency and nuclear experiments.

Unit–IV

Unit–V
Important human and veterinary parasites (protozoans and helminthes); life cycle and biology of Ascaris, Wuchereria, Fasciola, Schistosoma and Leishmania. Vermiculture and composting.
Books Recommended

IBTT 34 : BIOPHYSICAL CHEMISTRY

Unit–I

Unit–II
Chemical kinetics – Rates of reaction – first order and second order reactions. Rates for equilibrium and multistep processes. Activation energy and effect of catalysts on the energy of activation of reactions.

Unit–III

Unit–IV
Unit–V

Basic principles of NMR spectroscopy. FT NMR. $^1$H NMR spectra, chemical shift and coupling constant. $^1$H NMR spectra of simple organic molecules. Spin decoupling. Applications of $^1$H NMR in the study of biomolecules. Use of X – ray crystallography and CD in the study of proteins and nucleic acids.

Books Recommended

FOURTH SEMESTER

IBTT 41 : PROTEINS AND NUCLEIC ACIDS

Unit–I : Amino acids and peptides


Unit–II : Proteins – 1

Supersecondary structure – helix loop helix, hairpin $\beta$ motif and $\beta$ – $\alpha$ – $\beta$ motif. Structural classification of proteins based on protein motifs. Tertiary structure – $\alpha$ and $\beta$ domains. Quaternary structure. Structures of myoglobin, haemoglobin and tobacco mosaic virus.

Unit–III : Proteins – 2
Haemoglobin – oxygen binding, Hill equation, Bohr effect, changes in conformation on $O_2$ binding, Role of 2,3 – BPG. HbS, HbF. Models for haemoglobin alloster. Methods for determining protein conformation – X – ray diffraction, NMR, ORD and CD.

Methods for characterization and purification of proteins.
Unit–IV : Nucleic Acids
DNA double helical structure – Watson and Crick model. A, B, Z forms of DNA. Triple and quadruple structures. DNA supercoiling and linking number.

Properties of DNA: buoyant density, viscosity, hypochromicity, denaturation and renaturation – the cot curve. Chemical synthesis of DNA. Differences between DNA and RNA. Major classes of RNA – structure and biological function. Minor classes of RNA.

Unit–V : Nucleic Acid – Binding proteins
Nucleic acid recognition by proteins. DNA binding motifs in proteins – the helix – turn helix motif, zinc finger, the leucine zipper and helix – loop helix. RNA – binding motifs in proteins.

Techniques characterizing nucleic acid sequences that interact with proteins – gel retardation assay, Dnase I footprinting, modification protection, modification interference.

Books Recommended
8) Ferscht A. Structure and Mechanism in Protein Science: A guide to enzyme catalysis and protein folding.

IBTT 42 : ANALYTICAL TECHNIQUES

Unit–I : Spectroscopic Techniques

Unit–II : Radioisotope Techniques
Unit–III : Electrophoresis and Electrochemical techniques


Unit–IV : Chromatography


Unit–V : Centrifugation


Preparative ultracentrifuge – types and applications of preparative rotors.

Basic principle and technique of subcellular fractionation by differential centrifugation.

Density – gradient centrifugation – rate zonal and isopycnic. Formation and choice of gradients, sample application, recovery and monitoring.

Books Recommended

4) Simpson CFA & Whittacker, M. Electrophoretic techniques.
IBTT 43 : ENZYME TECHNOLOGY

Unit–I
Enzymes – general characteristics, classification and nomenclature, methods of enzyme isolation and purification. Methods of enzyme assay, Enzyme units, Katal, Specific activity and turnover number. Active site – investigation of active site structure. A brief account of nonprotein enzymes – ribozymes and DNA enzymes.

Unit–II

Kinetics of allosteric enzymes – MWC and KNF models. Hill’s equation and co – efficient. Sequential and non sequential bisubstrate reactions.

Unit–III

Mechanism of enzyme action – acid base catalysis, covalent catalysis, strain, proximity and orientation effects. Mechanism of action of lysozyme, chymotrypsin, DNA polymerases and RNase.

Unit–IV


Unit–V
Immobilization of enzymes and their applications. Enzyme engineering with reference to lysozyme. Abzymes.

Enzyme electrodes, enzyme biosensors and their applications, ELISA, EMIT.

Enzymes of industrial and clinical significance, sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, peptic enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production.

Therapeutic uses of enzymes: enzymes as thrombolytic agents and digestive aids.

Books Recommended

**IBTP 44 : PRACTICALS IN PROTEINS, NUCLEIC ACIDS AND ANALYTICAL TECHNIQUES**

1) Colour reactions and precipitation of proteins.
2) Estimation of proteins by Lowry et al method.
3) Estimation of proteins by Bradford method.
4) Thermal denaturation of DNA.
5) Estimation of DNA by diphenylamine method.
6) Estimation of RNA by orcinol method.
7) Estimation of phosphorous content of nucleic acids by Fiske and Subbarow method.
8) Desalting of proteins by dialysis.
9) Separation of sugars and amino acids by paper chromatography.
10) Two – dimensional paper chromatography.
11) Separation of lipids by thin – layer chromatography.
12) Separation of proteins by gel filtration – Demonstration.
13) Separation of plant pigments by adsorption chromatography – Demonstration.
15) UV – Absorption spectrum of proteins and nucleic acids – Demonstration.
16) HPLC – Demonstration.
IBTP 45: PRACTICALS IN ENZYME TECHNOLOGY

1) Determination of achromatic point in salivary amylase.
2) Determination of total and specific activity of salivary amylase and assay of serum ALP / ACP.
3) Time course of enzyme reactions (salivary amylase).
4) Effect of pH on enzyme activity (Urease or ALP).
5) Effect of temperature on enzyme activity (Urease/ALP) and determination of activation energy.
6) Effect of substrate concentration on enzyme activity (Urease/ALP) and determination of Km value.
7) Effect of inhibitor(s) on activity of any one enzyme (acid phosphatase).
8) Effect of activator(s) on activity of any one enzyme (salivary amylase).
9) Enzyme purification – Demonstration.

FIFTH SEMESTER

IBTT 51: METABOLISM AND REGULATION

Unit–I: Bioenergetics

Free energy and entropy. Phosphoryl group transfers and ATP. Enzymes involved in redox reactions. The electron transport chain – organization and role in electron capture.

Oxidative phosphorylation – electron transfer reactions in mitochondria. F1F0 ATPase – structure and mechanism of action. The chemiosmotic theory.

Inhibitors of respiratory chain and oxidative phosphorylation – uncouplers, ionophores. Regulation of oxidative phosphorylation.


Unit–II: Carbohydrate Metabolism


Unit–III: Lipid Metabolism

**Unit–IV : Metabolism of Amino Acids, Purines and Pyrimidines**


**Unit–V : Metabolic Integration and Hormonal Regulation**


**Books Recommended**


**IBTT 52 : MOLECULAR CELL BIOLOGY**

**Unit–I : Cell and tissue organization**


Types of tissues. Salient features of epithelial organization. The basement membrane and extracellular matrix.

**Unit–II : Membranes**

Membrane assembly – importins and exportins. Membrane transport: Diffusion (passive and facilitated). Active transport – symport, antiport, Na+ K+...
ATPase. Ion gradients, ion selective channels, group translocations, porins. Endocytosis and exocytosis.

**Unit–III : Cellular Communication, Cell Cycle, Cell Death**
Intercellular communication through gap junctions, tight junctions and desmosomes. Brief account of cell division (mitosis and meiosis) and cell differentiation.

The cell cycle – phases, regulation by cyclins and cyclin – dependent kinases.

Cell death – necrosis and apoptosis.

**Unit–IV : Cell Signaling**

**Unit–V : Techniques in Cell Biology**

**Books Recommended**
4) Twyman. Advanced Molecular Biology. Viva books. 2nd ed. (for Unit–IV)

**IBTT 53 : MICROBIOLOGY**

**Unit–I : Morphology and Ultrastructure**

Purple and green bacteria, cyanobacteria, homoacetogenic bacteria, Acetic acid bacteria, Budding and appendaged bacteria, spirilla, spirochaetes, Gliding and
sheathed bacteria, Pseudomonads, Lactic and propionic acid bacteria. Endospore forming rods and cocci, Mycobacteria, Rickettsia and Mycoplasma. Archaebacteria.

**Unit–II : Microbial growth and metabolism**


**Unit–III : Microbiological Techniques**


**Unit–IV : Viruses**


**Unit–V : Medical Microbiology**


**Books Recommended**


**References**

IBTT 54 : BIOSTATISTICS

Unit–I

Unit–II

Unit–III

Unit–IV
Basic concepts of sampling – Simple random sample, stratified sample and systematic sampling. Sample statistics. Sampling distribution and standard error. Tests of significance based large samples. Test for mean, difference of means, proportions and equality of proportions.

Unit–V

Books Recommended
3) S.P. Gupta, Fundamentals of statistics, Sultan Chand.

SIXTH SEMESTER
IBTT 61 : MOLECULAR BIOLOGY – I

Unit–I : Basic Mendelian Genetics
Definitions of some common terms in genetics – allele, character, gene, gene locus, genotype, hemizygous, heterozygous, homozygous, phenotype.

Unit–II : Chromatin

Molecular structure of the bacterial nucleoid – E.coli chromosome and DNA – binding proteins. Plasmids. Classification of plasmids by phenotype, structure and intrinsic properties. Some phenotypes conferred by plasmids.

Eukaryotic chromatin – nucleosome structure, histones and non – histone proteins.

Higher order chromatin structure – the 30 nm fiber, chromatin loops. Euchromatin and heterochromatin, DNase I sensitivity, CpG methylation.

Unit–III : Genome Complexity


Non coding DNA – unique sequence DNA, dispersed repetitive sequences (SINEs and LINEs), clustered repetitive sequences (satellite, minisatellite and microsatellite DNA). Organelle genomes – mitochondria, chloroplast.

Unit–IV : Replication

Replication – semiconservative mechanism. Enzymes involved in replication – helicases, SSB, topoisomerases, DNA polymerases, DNA ligase.


Unit–V : DNA damage, Repair and Recombination


Genetic recombination in bacteria – transformation, transduction and conjugation. Molecular biology of homologous recombination (the Holliday model) and site – specific recombination.


Books Recommended
2) Twyman Advanced Molecular Biology Viva Publ. 2nd ed. 1998.
IBTT 62 : IMMUNOLOGY AND IMMUNOTECHNOLOGY

Unit–I
Elements of Immunology. Types of immunity – innate and acquired. Humoral and cell mediated immunity. Central and peripheral lymphoid organs – Thymus, bone marrow, spleen, lymph nodes and other peripheral lymphoid tissues – GALT. Cells of the immune system – lymphocytes, mononuclear phagocytes – dendritic cells, granulocytes, NK cells and mast cells, cytokines.


Unit–II


Unit–III
MHC genes and products. Polymorphism of MHC genes, role of MHC antigens in immune response, MHC antigens in transplantation. Transplantation types.


Unit–IV

Fractionation of leucocytes by density gradient centrifugation. Identification of lymphocytes and their subsets in blood. Leukocyte migration inhibition technique. Delayed type hypersensitivity technique.
Unit–V


Books Recommended
6) NMS Series in Immunology. 3rd ed. Lippincott Williams & Wilkins.

IBTT 63 : FOOD TECHNOLOGY

Unit–I : Microorganisms in food

Biotechnology in relation to the food industry. Nutritive value of food. Types and sources of microorganisms associated with food. Conditions that influence microbial growth in food – intrinsic and extrinsic factors. Estimating the number of microorganisms in food.

Unit–II : Food Preservation


Unit–III : Food Spoilage

Composition and spoilage of food, meat, fish, cereals, pulses, nuts and oil seeds, fruits and fruit products, vegetable and vegetable products.

Unit–IV : Food – Borne Diseases


Unit–V : Fermented Foods

Books Recommended

IBTP 64 : PRACTICALS IN CELL AND MOLECULAR BIOLOGY
1) Identification of tissue types, phases of cell division.
2) Isolation of cells – lymphocytes, liver cells.
3) Microscopic examination of blood cells, epithelial cells, plant cells.
4) Cell fractionation – isolation of mitochondria and chloroplasts.
5) Separation of erythrocyte membrane and effect of detergents.
6) Metaphase chromosome preparation.
7) Isolation of DNA from rat liver.
8) Isolation of RNA from yeast.
9) Determination of base composition of nucleic acids.
10) Isolation of mRNA by affinity chromatography – Demonstration.
11) Isolation of plasmids and characterization by electrophoresis.
12) DNA electrophoresis in agarose gel.
13) In vitro transcription and translation (Demonstration).
14) Bacterial conjugation (Demonstration).
15) Bacterial gene expression (Demonstration).

IBTP 65 : PRACTICALS IN MICROBIOLOGY, IMMUNOLOGY AND FOOD TECHNOLOGY
1) Preparation of liquid and solid media for growth of microorganisms.
2) Isolation and maintenance of organisms by plating, streaking and serial diluting methods. Slants and swab culture.
3) Isolation of pure cultures from soil and water.
4) Growth curve, measurement of bacterial population by turbidimetry and serial dilution methods.
5) Effect of temperature, pH and carbon and nitrogen sources on growth.
6) Microscopic examination of bacteria, yeast and molds and study of organisms by Gram stain, Acid fast stain.
7) Assay of antibiotics.
8) Bacterial transformation.
9) Biochemical characterization of selected microbes.
10) Immunodiagnostics.
11) Radial immunodiffusion.
12) Double diffusion.
13) Immunoelectrophoresis.
14) Microbial production of citric acid using *Aspergillus niger*.
15) Evaluation of milk quality.
16) Isolation of microbes from spoiled vegetables.

**SEVENTH SEMESTER**

**IBTT 71 : MOLECULAR BIOLOGY – II**

**Unit–I : Prokaryotic Transcription and Regulation**


**Unit–II : Eukaryotic Transcription and Regulation**


**Unit–III : Genetic Code, Translation**


Components of protein synthesis – mRNA, ribosomes and tRNA. Mechanism of protein synthesis in bacteria and eukaryotes – amino acid activation, initiation, elongation and termination. Translational control in bacteria and eukaryotes.


Protein targeting – the signal sequence hypothesis, targeting proteins to membranes, nucleus and intracellular organelles.

Protein degradation: the ubiquitine pathway. Protein folding – models, molecular chaperones.

**Unit–IV : Gene Expression and Regulation**


Comparison of gene regulation strategies in prokaryotes and eukaryotes.

Genetic and epigenetic gene regulation by DNA methylation. DNA methylation in prokaryotes – restriction – modification systems, Dam methylation, Dcm

**Unit–V : Molecular Oncology**


**Books Recommended**


**IBTT 72 : BIOPROCESS ENGINEERING AND DOWNSTREAM PROCESSING**

**Unit–I**


**Unit–II**

- Bioreactors – design, parts and their function. Types of reactors. Types of fermentation processes: Analysis of batch, fed-batch and continuous bioreactions, stability of microbial reactors, analysis of mixed microbial population, specialized bioreactors (pulsed, fluidized, photobioreactors etc.).

  Heat transfer and shear effects in culture. Mass transfer; introduction, mass transfer steps, effect of scale on mass transfer.

**Unit–III**


Unit–IV


Process economics: The starting point, cost estimates, capital and operating costs. Process design and design exercise.

Unit–V

Industrial production of alcohol (ethanol), acids (citric, lactic, acetic and gluconic acids) solvents (glycerol, acetone, butanol) antibiotics (penicillin, streptomycin, tetracyclin, cephalosporin) amino acids (lysine, glutamate, threonine, phenylalanine, tryptophan, asparatate).

Whole cell immobilization and their industrial applications.

Books Recommended

References

IBTT 73 : ENVIRONMENTAL BIOTECHNOLOGY

Unit–I


Unit–II

Water pollution and its control. Water as a scarce natural resource, Need for water management, Measurement of water pollution, Sources of water pollution,

Unit–III

Unit–IV
Renewable sources of energy (waste materials, biogas, energy crops, cellulose); energy and fuel using microorganisms (hydrogen production using hydrogenase and nitrogenase, hydrocarbon production). Conservation of energy.

Bioremediation – use of microorganisms in mixing. Global environmental problems; Ozone depletion, UV – B, greenhouse effect, their impact and biotechnological approaches for management.

Unit–V


Books Recommended
IBTT 74 : MARINE BIOTECHNOLOGY

Unit–I
Water quality assessment in the marine environment – dissolved oxygen, nutrients, pH, temperature and salinity, Pollution – types of pollutants, monitoring and control measures through biotechnology (probe development and molecular markers), bioremediation – recovery of metals from effluents.

Unit–II
Microalgae: Diatoms, dinoflagellates, cyanobacteria; sources of occurrence, culture techniques – mass culture, culturing through bioreactors. Seaweeds – types, niches, economic importance; tissue culture and cultivation techniques. Mangroves types, habitats, economic importance; culture technique – tissue culture.

Unit–III
Hatchery technology – larval rearing, mass production of seeds. Brackish water aquaculture technology – crustacean culture – selection of important species, culture techniques, live feed production and feed formulation.


Unit–IV
Microbial techniques – Methods of isolation of microbes from the sea water and associated marine organisms, useful marine microbes – Probiotics, application of microbial biotechnology in culture ponds, sea food microbiology – processing methods, products, microbial quality and value addition.

Unit–V
Bioactive compounds from marine sources – Methods of isolation chromatographic techniques, documentation. Marine toxins and their biological properties – evaluation of marine toxins through in vitro and in vivo models.

Books Recommended
IBTP 75 : PRACTICALS IN BIOPROCESS ENGINEERING, DOWNSTREAM PROCESSING AND ENVIRONMENTAL BIOTECHNOLOGY
1) Preparation of Immobilized Cell / Enzyme beads using alginate.
2) Isolation of microorganisms.
3) a) Determination of growth curve of a microorganism and
   b) Determination of substrate degradation profile.
4) Computation of specific growth rate (m) & growth yield $Y_{x/s}$
5) Comparative studies of ethanol production using different substrates.
6) Microbial production of citric acid using *Aspergillus niger*.
7) Determination of total dissolved solids of water.
8) Determination of D.O Concentration of water sample.
9) Determination of BOD of a sewage sample.
10) Determination of COD of a sewage sample.
11) Estimation of nitrate in drinking water.
12) Efficiency of removal of air pollutants using fibrous air filter.
13) Production and estimation of Alkaline protease.

IBTP 76 : PRACTICALS IN MARINE BIOTECHNOLOGY
1) **Water quality analysis** – Physiochemical parameters.
2) **Micro and Macroalgal Segregation and Culture** – mass culture of microalgae, tissue culture.
3) **Aquaculture techniques**
   Identification of larval stages, culture practices, induced breeding – pituitary inducement, eye stalk ablation and stage segregation.
4) **Microbial techniques**
   Estimation of aerobic plate counts from sea foods.
   Estimation of total Coliforms from sea foods.
   Estimation of Vibrio cholera.
   Estimation of Salmonella.
   Antagonistic activity of marine microbes.
5) Extraction of Bioactive compounds.
   Solvent extraction techniques, Chromatography, Electrophoresis.

6) Molecular Disease Diagnostic techniques.
   Slide agglutination, precipitation, ELISA, PCR.

**EIGHTH SEMESTER**
**IBTT 81: GENETIC ENGINEERING**

**Unit–I : Restriction Enzymes and Cloning Vectors**
   Basic principles of recombinant DNA technology. Restriction endonucleases – nomenclature and mechanism of action of type II restriction enzymes.


**Unit–II : rDNA Transfer and Screening**


   Screening of recombinants: Marker inactivation (antibiotic resistance, blue – white selection), nucleic acid hybridization (colony, plaque, gridded) immunological screening for expressed genes, screening by protein activity.

**Unit–III : Expression Systems**
   Expression vectors: vectors for maximizing protein synthesis, protein purification, solubilization and expressed proteins and promote protein export.

   Prokaryotic expression systems: Expression of cloned genes in *E. coli* – promoter efficiency, increasing protein production (mRNA and protein stability), fusion proteins, translation expression vectors, plasmid copy number and stability. Cloning in *Bacillus subtilis*.

   Eukaryotic expression systems: Yeast vectors (YEPs, YRPs, YCPs, YACs, Ty). Expression of cloned genes and overexpression of proteins in yeast. Secretion of heterologous proteins by *S. cerevisiae*.

   Cultured insect cell expression systems – baculovirus transfer vector. Mammalian cell expression systems.

**Unit–IV : Techniques**
PCR – basic reaction, factors affecting PCR, applications of PCR. Modified PCR
techniques – RT – PCR, real – time quantitative PCR, RACE, RAPD, Ligase chain
reaction.

Sequencing: Basic DNA sequencing. Chemical and enzymatic methods.
Modification of chain terminator sequencing, automated DNA sequencing.

Synthesis of genes, gene synthesis machines.

**Unit–V : SDM, Protein and Metabolic Engineering**

Site – directed mutagenesis: cassette mutagenesis, oligonucleotide – directed
mutagenesis. PCR methods of SDM. Selection of mutant peptides by phage and
phasmid display.

Use of SDM for protein engineering to improve enzymes and therapeutic
proteins, protein engineering by directed evolution and DNA shuffling.

Metabolic engineering: designed overproduction of phenylalanine, novel routes
to small molecules. Combinatorial biosynthesis, engineering metabolic control over
recombinant pathways, metabolic engineering in plant cells. Applications of rDNA
technology.

**Books Recommended**

4) Winnaecker from Genes to Clones. VCH Publ. 1987.

**IBTT 82 : PLANT BIOTECHNOLOGY**

**Unit–I : Plant Molecular Biology**

Structure of plant genes. Organisation of plant chromatin. The nuclear,
chloroplast and mitochondrial genomes.

Symbiotic nitrogen fixation in legumes by Rhizobia – Biochemistry and
molecular biology. Regulation of nif and nod genes. Biofertilizers and Biopesticides –
production and applications.

**Unit–II : Plant Tissue Culture – I**

Conventional plant breeding. Cell and tissue culture. Tissue culture as a
technique to produce novel plants and hybrids. Tissue culture media (composition
and preparation). Micropropagation. Somaclonal variation. Phytochemicals from
plant tissue culture. Other uses of tissue culture (endosperm and nucellus
cultures, germplasm storage including cryopreservation).
**Unit–III : Plant tissue Culture – II**

Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Detection of haploids. Uses of haploids in plant breeding. Protoplast isolation, culture and fusion, selection of hybrid cells and regeneration of hybrid plants, cybrids.

**Unit–IV : Gene Transfer Methods**


Control of transgene expression in plants, selectable markers for plants – drug resistance and herbicide resistance markers.

**Unit–V : Transgenic Plant Technology**

Developing plant strains by genetic engineering – Insect resistant, virus resistant, fungal resistant, herbicide resistant plants, Male infertility, stress and senescence tolerant plants. Modification of production traits – delayed ripening, modification of starch, oil, vitamin, mineral content and seed storage protein. Plants as bioreactors – production of vaccines and antibodies, edible vaccines.

**Books Recommended**

IBTT 83: ANIMAL BIOTECHNOLOGY

Unit–I: Animal Cell Culture – I

Animal cell and tissue culture – History and scope – advantages and disadvantages, laboratory facilities, the substrate, culture media and culture procedures.

Primary culture, cell lines, maintenance of cultures, cell lines. Cloning of cell lines. Cancer cell lines.

Unit–II: Animal Cell Culture – II

Tissue culture: slide, flask and test tube culture. Organ culture, whole embryo culture. Somatic cell hybridization genetic analysis using cell hybridisation and expression of cloned genes in cultured cells.

Stem cells – isolation, identification, expansion, differentiation and uses. Stem cell engineering.

Unit–III: Manipulation of Animal Reproduction and Characterization of Animal Genes

Manipulation of reproduction in animals: Artificial insemination, Embryo transfer, IVF, Embryo cloning. Characterising and isolating animal genes – homologues, linked markers and linkage mapping, bulked segregant analysis, direct identification of novel genes. Production of recombinant vaccine for foot and mouth disease.

Unit–IV: Gene Transfer Methods

Gene transfer to animal cells – Introduction, DNA/Ca phosphate coprecipitation, phospholipids as gene delivery vehicles, Electroporation, direct transfer methods. Transfer with nonreplicating DNA.

Selectable markers for animal cells, CAT, SeAP, Transformation with replicon vectors, gene transfer by viruses – adenoviruses, baculoviruses, herpes, retroviruses, vaccinia, α – viruses. High level transgene expression in animal cells.

Unit–V: Transgenic Animals

Methods for producing transgenic mice Retroviral, DNA microinjection and engineered stem cell methods. Applications of transgenic mice. Transgenic cattle, sheep, goats, pigs and fish.

Transgenic animals as models of human disease.

Books Recommended
**IBTP 84 : PRACTICALS IN GENETIC ENGINEERING**

1) Extraction of genomic DNA.
2) Determination of molecular size of DNA.
3) Plasmid preparation.
4) Restriction enzyme digestion of DNA.
5) Phage titration.
6) Ligation of DNA fragments.
7) Separation of DNA by PAGE.
8) Separation of DNA by PFGE – Demonstration.
9) Restriction mapping.
10) Transformation.
11) PCR and analysis of PCR products – Demonstration.
12) Blotting techniques – Southern, Northern, Western – Demonstration.
13) GFP cloning.

**IBTP 85 : PRACTICALS IN PLANT AND ANIMAL BIOTECHNOLOGY**

1) Preparation of media.
2) Surface sterilization.
3) Culture propagation, organogenesis, transfer of plants to soil.
4) Protoplast isolation and culture.
5) Anther culture, production of haploids.
6) Isolation of DNA from plants.
7) Preparation of tissue culture medium and membrane filtration.
8) Preparation of single cell suspension from spleen and thymus.
9) Cell counting and cell viability.
10) Macrophage monolayer from PEC, and measurement of phagocytic activity.
11) Trypsinization of monolayer and subculturing.
12) Cryopreservation and thawing – Demonstration.
13) Role of serum in cell culture.
14) Preparation of metaphase chromosomes from cultured cells.
15) Isolation of DNA and demonstration of apoptosis by DNA laddering – Demonstration.
16) MTT assay for cell viability and growth.
17) Cell fusion with PEG.
Unit–I


Unit–II

Assembling a physical map of the genome – chromosome walking and jumping. Restriction enzyme fingerprinting. Sequence tagged sites, radiation hybrid mapping, ESTs. Hybridization assays – hybridization mapping, hybridization reference library, in situ hybridization.

Unit–III

Conventional genome sequencing. Sequencing without mapping. STC approach. Whole genome sequencing. cDNA sequencing. Hierarchical shotgun sequencing and shotgun sequencing. Analyzing sequence data – database searches, sequence analysis at whole genome level.

Unit–IV


Unit–V

Genome Projects: genome sequence data of model organisms – E.coli, D.melanogaster, A.thaliana and mouse. The human genome project – goals, mapping strategies, markers, sequencing technologies, results of final sequence, potential benefits and risks. Ethical, legal and social issues (ELSI).


Books Recommended

Unit–I : Introduction

Unit–II : Techniques

Unit–III : Databases and Protein Interactions

Protein – protein interactions, protein – other interactions, the interactive, molecular proteomics – small molecule inventory (SMI).

Unit–IV : Structure Function and Structure Prediction
Protein structure – function relationship, the evolution of protein structure and function. Obtaining, viewing and analysing structural data, structural alignment classifications of protein structures. CATH and SCOP.

Protein structure prediction – secondary structure prediction. Tertiary structure prediction – homology modeling, protein threading, ab initio protein folding.

Unit–V : Applications


Books Recommended
References

**IBTT 93 : BIOINFORMATICS**

**Unit–I : Introduction**
Introduction to bioinformatics, scope of bioinformatics, role of computers in biology. The internet, the world wide web, useful search engines – Boolean searching, search engine algorithms. Finding scientific articles – Pubmed.
Running computer software, computer operating systems. Software downloading and installation.

**Unit–II : Workstation**
The bioinformatics workstation, Unix system, files and directories in Unix, working on a Unix system.
Scripting languages – Perl and Python, markup languages – HTML, XML.

**Unit–III : Databases**
Database concepts – Database, database system, database management systems – Hierarchical, Rational and Network, Database security.
Biological databases, Types – sequence and structure databases. Genome and organism specific databases. Miscellaneous databases. Data submission, data retrieval with Entrez, DBGET / Link DB and SRS.

**Unit–IV : Database Searches and Sequence Alignment**
Searching sequence database sequence similarity searches, amino acid substitution matrices, Database searches: FASTA and BLAST, sequence filters, Iterative database searches and PSI – BLAST.

**Unit–V : Applications**
Metabolic pathways – Kegg and Wit, primer design, Microfluidics.
Books Recommended

IBTT 94: DRUG DESIGN AND DRUG ACTION

Unit–I

Unit–II

Unit–III

Unit–IV

Unit–V
Receptor – structure, ligand gated ion channel, G – protein coupled receptors. Tyrosine kinase enzyme coupled receptors, steroid receptors. Enzyme inhibition as a tool for drug design. Molecular modeling in drug design.

**Book Recommended**

1) Gilman et al., Goodman & Gilman’s The Pharmacological Basis of Therapeutics 10th ed. McGraw Hill.


5) Smith, Smith and Williams Introduction to the Principles of drug design. 2nd ed. Wright Publications.

**IBTP 95 : PRACTICALS IN BIOINFORMATICS**

1) Sequence alignment and searching.
2) Gene prediction.
3) Multiple sequence alignment.
4) Phylogenetic analysis.
5) Protein sequence analysis.
6) Protein structure prediction.
7) Protein structure alignment and comparison.
8) Primer design.
9) SNP finding in DNA sequence.
10) ORF finding in DNA sequence.
11) Visualization tools.

**TENTH SEMESTER**
**IBTT 101 : MEDICAL BIOTECHNOLOGY**

**Unit–I : Molecular Basis of Disease**

Genetic diseases. Chromosomal disorders (Down’s syndrome, Klinefelter’s syndrome), Monogenic disorders (autosomal dominant, autosomal recessive, sex – linked).


**Unit–II : Immunotherapeutics and Tissue Typing**

Monoclonal antibodies as therapeutic agents – chemical linked MAbs, Human MAbs, Hybrid human – mouse MAbs, Growth factors and interferons as therapeutic agents.
Tissue Transplantation – MHC class I and II genes, Histocompatibility testing – lymphocytotoxicity test, cross matching. MHC and disease association. Graft versus host reaction, Immunosuppression.

Unit–III : Molecular Diagnosis
Prenatal and Neonatal screening. DNA diagnostic systems – hybridization probes, nonradioactive probes. RFLPs and PCR in disease diagnosis – PCR/OLA procedure, immunoPCR, DNA profiling – sample preparation, VNTR analysis.

Unit–IV : Cancer and AIDS


Unit–V : Molecular Therapeutics and Bioethics


Books Recommended

BIOO 415 : BASIC BIOTECHNOLOGY (OPTIONAL)

Unit–I : Fermentation Biotechnology
Basic principles of microbial growth. The bio reactor – types and operation. Fermentation culture medium. Downstream processing.

Unit–II : Food and Enzyme Technology
Biotechnology in food industry – food fermentation, fermented foods and milk products. Immobilised cells and enzymes – methods of immobilisation, properties and applications.

Unit–III : Energy and Environmental Biotechnology
Unit–IV : Recombinant DNA Technology
Structure of DNA and RNA. Gene organisation and flow of genetic information (elementary details only). Basic principles of cloning: restriction endonucleases, cloning vectors, introduction into host by electroporation and microinjection, selection and screening of recombinants.

Unit–V : Plant and Animal Biotechnology
Applications of rDNA technology in agriculture and animal husbandry: development of transgenic plants and animals – basic principles and applications. The human genome project (elementary details only).

Books Recommended
1) Biotechnology J.E. Smith Cambridge Univ. Press, 1996.