

**ANNAMALAI UNIVERSITY**  
**DEPARTMENT OF ZOOLOGY**  
**M.Sc Zoology**  
**FIVE YEAR INTEGRATED DEGREE**  
**ON CAMPUS PROGRAMME (CBS)**  
**Regulations**  
**2014-2015**

**Common to all Departments of studies in the Faculty of Science**

**Mathematics, Statistics, Physics, Chemistry. Botany. Zoology, Earth Sciences, Biochemistry.**

**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 programmes interms and hours of study. It indicates differential weightage given according to the contents and duration of the courses in the Curriculam design.

The minimum credit requirement for the award of the Degree of Five Year Master's Programmes shall be 225.

**Courses**

Each course may consists 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 examinations of the plus 2 Higher Secondary Course and Equivalent thereto with a minimum of 40% aggregate under Academic Stream with the following subjects as in Appendix – A, conducted by the Board of Secondary Education, Tamilnadu Government or an examination of any other authority accepted by the syndicate of the this University as equivalent thereto. 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 indicate 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.

**Students 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 members of the faculty who shall function as student counselor 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 Calendar 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 candidates 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**

**The internal assessment for each course carries 25% marks for theory and 40% marks for practical and it is based on two internal assessment tests and a variety of assessment tools such as seminar and assignment. The respective faculty will decide the pattern of question paper. The tests are compulsory.**

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

**Sessional Test - 1 will be held during sixth week for the syllabi covered till then.**

**Sessional Test –I will be 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 to the respective faculty Sessional Test -1 will carry 25 of marks of the entire course.**

**Sessional Test –II will be conducted with a variety of assessment tools. It will also have an elements of openness. The students are to be informed in advance about the nature of assessment and the procedures. However. The tests ate compulsory. Test II may be for two hours duration.**

**The pattern of question paper will be decided by the respective Faculty. (Sessional Test –II) Carry 25 marks of the entire course average of sessional I & II will be taken.**

**There will be one End Semester Examination (75% marks for theory and 60% marks for Practical) of 3 hours duration for each course. The respective faculty will decide the pattern of question paper.**

## **Evaluation**

**Evaluation will be done on a continuous basis. Evaluation may be 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 2<sup>nd</sup> Semester onwards will be marked by OGPA.**

### **Marks and Grading**

**A student cannot repeat the assessment of Sessional Test -1 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.**

**If a candidates 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 still the regulations are in force. However, a candidate cannot move to the next odd/even semester if he/she 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.**

<b>Marks</b>	<b>Grade Points</b>	<b>Letter Grade</b>	<b>Class</b>
<b>90+</b>	<b>10</b>	<b>S</b>	<b>Exemplary</b>
<b>85-89</b>	<b>9.0</b>	<b>D++</b>	<b>Distinction</b>
<b>80-84</b>	<b>8.5</b>	<b>D+</b>	<b>Distinction</b>
<b>75-79</b>	<b>8.0</b>	<b>D</b>	<b>Distinction</b>
<b>70-74</b>	<b>7.5</b>	<b>A++</b>	<b>First Class</b>
<b>65-69</b>	<b>7.0</b>	<b>A+</b>	<b>First Class</b>
<b>60-64</b>	<b>6.5</b>	<b>A</b>	<b>First Class</b>
<b>55-59</b>	<b>6.0</b>	<b>B</b>	<b>Second Class</b>
<b>50-54</b>	<b>5.5</b>	<b>C</b>	<b>Second Class</b>
<b>49 or less</b>	<b>-</b>	<b>RA</b>	<b>Reappear</b>

**The successful candidate in the Core Subjects are classified as follows.**

**I - 60% marks and above in over all percentage of marks (OPM)**

**II - Class 50-59% marks in over all percentage of marks**

**Candidates who obtained 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 course prescribed for programme at the first appearance.**

**Candidate who obtain highest marks in all examinations at the first appearance alone considered for ranking.**

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

**Test (10 + 10) : 20 Marks**

**Assignment : 05 Marks**

**Total 25 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 over all grades other than RA. A letter grade RA 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 RA 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 for clearance for the arrears.

If a student secures RA Grade in the Project Work/Field Work/Practical Work /Dissertation work 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 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.

### **Appendix - A**

<b>M.Sc ( Zoology)</b>	<b>:</b>	<b>A Pass in H. Sc (10 + 2 Level) or Equivalent thereto with a minimum of 40% Aggregate under academic stream with the following subjects Viz. Physics &amp; Chemistry , Biology or Zoology and Botany</b>
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**Five Year Integrated M.Sc Zoology**

Code No	Theory/Practical	L	P	C	Int. Mark 25	Ext. Marks 75	Total 100
<b>I SEMESTER</b>							
ITAC 11	Language - I/Paper I	3		3	25	75	100
IENC 12	Language-II /Paper I	3		3	25	75	100
ICEC 13	Civics , Environment awareness and Health science	3		3	25	75	100
IZOT 14	Invertebrata I	5		5	25	75	100
ABOT 01	Ancillary I - Botany I	4		4	25	75	100
	<b>Total</b>	<b>18</b>		<b>18</b>			
<b>II SEMESTER</b>							
ITAC 21	Language -I Paper II	3		3	25	75	100
IENC 22	Language-II Paper II	3		3	25	75	100
ICAC 23	Computer applications I	3		3	25	75	100
IZOT 24	Invertebrata II Tutorial/ Group Discussion	5 1		6	25	75	100
ABOT 02	Ancillary I- Botany II	4		4	25	75	100
IZOP 25	Core Practical I Pre-Lab Discussion Practical I (Covering IZOT14&24)		1 6	3	40	60	100
ABOP 01	Ancillary practical I (Covering ABOT 01 & 02)		6	2	40	60	100
	<b>Total</b>	<b>19</b>	<b>13</b>	<b>24</b>			
<b>III SEMESTER</b>							
ITAC 31	Language -I Paper III	3		3	25	75	100
IENC 32	Language-II Paper III	3		3	25	75	100
ACHT 03	Ancillary II - Chemistry I	5		5	25	75	100
IZOT 33	Chordata I Tutorial/ Group Discussion	5 1		6	25	75	100
IZOP 34	Core Practical II Pre-Lab Discussion Practical II (Covering IZOT 33)		1 6	3	40	60	100
	<b>Total</b>	<b>17</b>	<b>7</b>	<b>20</b>			
<b>IV SEMESTER</b>							
ITAC 41	Language -I Paper II	3		3	25	75	100
IENC 42	Language-II Paper II	3		3	25	75	100
ACHT 04	Ancillary II - Chemistry II	5		5	25	75	100
IZOT 43	Chordata II Tutorial/ Group Discussion	5 1		6	25	75	100
IZOP 44	Core Practical III Pre-Lab Discussion Practical III (Covering IZOT 43)		1 6	3	40	60	100
ACHP 02	Ancillary Practical II Ancillary Practical (covering ACHP 03 & 04)		7	3	40	60	100
	<b>Total</b>	<b>17</b>	<b>14</b>	<b>23</b>			
<b>V SEMESTER</b>							
IZOT 51	Functional Anatomy	5		5	25	75	100
IZOT 52	Molecular cytogenetics	5		5	25	75	100
IZOT 53	Cellular and molecular basis of development	5		5	25	75	100
IZOT 54	Evolution & Animal behaviour	5		5	25	75	100
IZOP 55	Core Practical IV Pre-Lab Discussion Practical IV(covering IZOT 51,52,53 & 54)		1 10	5	40	60	100
	<b>Total</b>	<b>20</b>	<b>11</b>	<b>25</b>			

	<b>VI SEMESTER</b>						
<b>IZOT 61</b>	<b>Comparative Animal Physiology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 62</b>	<b>Ecology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 63</b>	<b>Applied zoology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 64</b>	<b>Tools and Techniques of Biology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOP 65</b>	<b>Core Practical V Pre-Lab Discussion Practical V (Covering IZOT 61, 62,63 &amp; 64)</b>		<b>1 11</b>	<b>5</b>	<b>40</b>	<b>60</b>	<b>100</b>
	<b>Total</b>	<b>20</b>	<b>12</b>	<b>25</b>			
	<b>Total upto VI Semester</b>			<b>135</b>			
	<b>VII SEMESTER</b>						
<b>IZOT 71</b>	<b>Developmental Biology</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 72</b>	<b>Cell Biology</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 73</b>	<b>Genetics</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOP 74</b>	<b>Core Practical VI Pre lab discussion Practical VI (Covering IZOT 71, 72 &amp; 73)</b>		<b>1 9</b>	<b>4</b>	<b>40</b>	<b>60</b>	<b>100</b>
	<b>Total</b>	<b>12</b>	<b>10</b>	<b>16</b>			
	<b>VIII SEMESTER</b>						
<b>IZOT 81</b>	<b>Animal Physiology</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 82</b>	<b>Molecular Biology</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 83</b>	<b>Environmental Biology</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOP 84</b>	<b>Core Practical VII Pre lab discussion Practical VII (Covering IZOT 81, 82 &amp; 83)</b>		<b>1 9</b>	<b>4</b>	<b>40</b>	<b>60</b>	<b>100</b>
	<b>Soft Skill ( English communication)</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT O 85</b>	<b>Optional I</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
	<b>Total</b>	<b>20</b>	<b>10</b>	<b>24</b>			
	<b>IX SEMESTER</b>						
<b>IZOT 91</b>	<b>Biotechnology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 92</b>	<b>Immunology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 93</b>	<b>Toxicology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOP 94</b>	<b>Core Practical VIII Pre lab Discussion Practical VIII (covering IZOT 91, 92 &amp; 93)</b>		<b>1 9</b>	<b>4</b>	<b>40</b>	<b>60</b>	<b>100</b>
<b>IZOT O 95</b>	<b>Optional II</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
	<b>Total</b>	<b>19</b>	<b>10</b>	<b>23</b>			
	<b>X SEMESTER</b>						
<b>IZOT 101</b>	<b>Entomology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 102</b>	<b>Fisheries and Aquaculture</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT 103</b>	<b>Endocrinology</b>	<b>5</b>		<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOP 104</b>	<b>Core Practical IX Pre lab discussion Practical IX (covering IZOT 101, 102 &amp; 103)</b>		<b>1 8</b>	<b>4</b>	<b>40</b>	<b>60</b>	<b>100</b>
<b>IZOT O 105-1 (or) IZOT O 105-2</b>	<b>Optional III 1-Public Health &amp; Hygiene (or) 2-Animal Science</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IZOT O 106-1 (or) !ZOT O 106-2</b>	<b>Optional IV 1-Animal Culture Technique (or) 2-Environmental Science</b>	<b>4</b>		<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
	<b>Total</b>	<b>23</b>	<b>9</b>	<b>27</b>			
	<b>Total VII to X Semester</b>			<b>90</b>			
	<b>Grand Total</b>			<b>225</b>			

**Optional Courses offered by Department of Zoology in the  
X Semester**

<b>Semesters &amp; Code</b>	<b>Title</b>	<b>L</b>	<b>P</b>	<b>C</b>	<b>Int. Ass. Marks 25</b>	<b>End Sem. Exam Marks 75</b>	<b>Total Marks</b>
<b>X Semester</b>							
<b>Optional III IZOT O 105-1 (or) IZOT O 105-2</b>	<b>Public Health &amp; Hygiene (or) Animal Science</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Optional IV IZOT O 106-1 (or) IZOT O 106-2</b>	<b>Animal Culture Technique (or) Environmental Science</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>

**Optional Courses offered to Other Science Department in the  
VIII, IX and X Semesters**

<b>Semesters &amp; Code</b>	<b>Title</b>	<b>L</b>	<b>P</b>	<b>C</b>	<b>Int. Ass. Marks 25</b>	<b>End Sem. Exam Marks 75</b>	<b>Total Marks</b>
<b>VIII Semester Optional I IZOT O 85</b>	<b>Animal Culture Techniques</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>IX Semester Optional II IZOT O 95</b>	<b>Environmental Science</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>X Semester Optional III IZOT O 105</b>	<b>Public Health &amp; Hygiene</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Optional IV IZOT O 106</b>	<b>Animal Science</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>

**Ancillary Courses offered to Other Science Department in the  
I and II Semesters**

<b>Semesters &amp; Code</b>	<b>Title</b>	<b>L</b>	<b>P</b>	<b>C</b>	<b>Int. Ass. Marks 25</b>	<b>End Sem. Exam Marks 75</b>	<b>Total Marks</b>
<b>I Semester Ancillary I AZOT- 01</b>	<b>Ancillary Zoology-I Animal Diversity –I</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>II Semester Ancillary II AZOT-02</b>	<b>Ancillary Zoology-II Animal Diversity-II</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>AZOP-01</b>	<b>Pre lab Discussion</b>		<b>1</b>	<b>1</b>			
	<b>Practical Ancillary Zoology-I (Animal Diversity-I)</b>	<b>-</b>	<b>6</b>	<b>2</b>	<b>40</b>	<b>60</b>	<b>100</b>

**Theory Courses:**

**Internal Assessment Test -1**  
**Internal Assessment Test -II**  
**Assignment**

**Maximum Marks: 25**  
**10**  
**10**  
**05**  
**Total 25**

**Practical Courses:**

**Internal Test -1**  
**Internal Test -II**

**Maximum Marks : 40**  
**20**  
**20**  
**Total 40**



## **FIRST SEMESTER SYLLABUS FOR INTEGRATED M.Sc ZOOLOGY (5 Years)**

### **IZOT 14 – Invertebrata-I**

**Objective : To understand lower invertebrate diversity**

#### **UNIT I.**

**Principles of classification-salient features and classification upto orders in non-chordates. Structural organization in different classes of non-chordates.**

#### **UNIT II**

**Protozoa- Type study Entamoeba, Paramecium and Plasmodium study of locomotion , osmoregulation, nutrition and reproduction in protozoa.**

#### **UNIT III**

**Origin of metazoa-metamerism and symmetry. Porifera and coelenterata-Type study – Sycon spong, Obelia, Aurelia, corals and coral reefs, polymorphism in hydrozoa.**

#### **UNIT IV**

**Ctenophora-. Type study and affinities.**

#### **UNIT V**

**Platyhelminthes and Nematelminthes-Type study-Planaria, tape worm, liver fluke-reproduction and parasitic adaptations. Nematoda-Type study-Ascaris-nematode parasites-Salient features.**

#### **PRACTICALS**

- 1. Examination of paramecium, amoeba , euglena.**
- 2. Study of sycon ,hyalonema and spongilla from slides and specimens**
- 3. Slides and specimens of hydra , obelia, aurelia, sea-anemone, gorgonia, scyphytoms.**
- 4. Slides and specimens of Fasciola and Taenia**
- 5. Slides and specimens of ascaris**
- 6. Demonstration of earthworm and leech- internal organs.**
- 7. Transverse sections of tissues of leech and earthworm**

#### **TEXT BOOKS:**

- 1.M. Ekambaranatha Ayyar ,1973 A Manual of Zoology –Part –I , Invertebrata S.Viswanathan(Printers and Publishers)Pvt.Ltd.Madras.**
- 2.Jordon ,E.L and P.S .Verma ,1985, Invertebrate Zoology. S.Chand and Co. Ltd.New Delhi**
- 3.Adam Sedgwick,1960, A students text book of zoology Vol I .General book depot.Allahabad.**
- 4.1960, A students text book of zoology Vol III General book depot. Allahabad.**
- 5.Hyman,L.H. The Invertebrate 1951, Vol.I, McGraw Hill Book Co,Newyork,London**
- 6.Hyman ,L.H. The Invertebrate 1951 Vol.II, McGraw Hill Book Co., New York, London.**
- 7.Hyman,L.H. The Invertebrate 1951, Vol.III, McGraw Hill Book Co.,New York, London**
- 8.Hyman.L.H, The Invertebrate 1959, Vol.IV McGraw Hill Book Co.New York,London**
- 9.Hyman L.H, The Invertebrate 1959, Vol.V McGraw Hill Book Co.New York London**

**SECOND SEMESTER**  
**IZOT 24 - Invertebrata-II**

**Objective: To understand higher invertebrate diversity**

**UNIT I**

**Annelida –Salient features-Type study-Earthworm, Nereis , Leech-Coelom and excretory system-adaptive radiation in polychaetes.**

**UNITII**

**Onychopora-Type study and affinities**

**UNIT III**

**Arthropoda-Salient features-classification upto orders – Type study – Penaeus and grasshopper ; Limulus and its affinities.**

**UNIT IV**

**Molluscs-Salient features-classification upto orders-Type study-Fresh water mussel and sepia; torsion in mollusca, foot in mollusca, shell in mollusca .**

**UNIT V**

**Echinodermata-Salient features-classification upto orders-Type study-Asterias-Echinoderm larvae-their significance**

**PRACTICALS:**

- 1. Cockroach – demonstration of internal organs and mounts**
- 2. Prawn- demonstration of internal organs and mounts**
- 3. Spiders, ticks, mites – specimens**
- 4. Pila – demonstration**
- 5. Mounts of Radula, ctenidium**
- 6. Echinoderm -specimen study**
- 7. Minor phyla-specimen study**

**TEXT BOOKS:**

- 1.M. Ekambaranatha Ayyar ,1973, A Manual of Zoology –Part –I, Invertebrata S.Viswanathan(Printers and Publishers)Pvt.Ltd.Madras.**
- 2.Jordon ,E.L and P.S .Verma ,1985, Invertebrate Zoology. S.Chand and Co. Ltd.New Delhi**
- 3.Adam Sedgwick,1960, A students text book of zoology Vol I .General book depot.Allahabad.**
- 4 1960, A students text book of zoology Vol II General book depot. Allahabad.**
- 5.1960, A students text book of zoology Vol III General book depot.Allahabad**
- 6. Hyman,L.H. The Invertebrate 1951, Vol.I, McGraw Hill Book Co,Newyork,London**
- 7.Hyman ,L.H. The Invertebrate 1951 Vol.II, McGraw Hill Book Co., New York, London.**
- 8. Hyman,L.H. The Invertebrate 1951, Vol.III, McGraw Hill Book Co.,New York, London**
- 9. Hyman.L.H, The Invertebrate 1959, Vol.IV McGraw Hill Book Co.New York,London**
- 10. Hyman L.H, The Invertebrate 1959, Vol.V McGraw Hill Book Co.New York London**

**THIRD SEMESTER  
IZOT 33 – Chordata I**

**Objective:**

To make the students to understand the origin, salient features, classifications, organizations, and structure of prochordates and chordates, origin and evolution of various classes of chordates and comparative anatomy of systems in chordates.

**UNIT I Protochordata -General characters of Hemichordata, Urochordata and Cephalochordata and their larval forms. Retrogressive metamorphosis in Urochordata**

**UNIT II Chordate Origin -Dipleurula concept and the Echinoderm theory of origin of chordates**

**Agnatha - salient features-Type study-affinities**

**UNIT III: Vertebrata -Advanced features over Protochordata**

**UNIT IV : Agnatha -General characters and classification of cyclostomes up to class**

**UNIT V - Pisces-General characters of *Chondrichthyes* and *Osteichthyes* and classification up to order Migration in fishes, Osmoregulation, Parental care**

**PRACTICALS:**

**1. Protochordata**

*Balanoglossus, Herdmania, Branchiostoma, Colonial Urochordata*

**Sections of *Balanoglossus* through proboscis and branchiogenital regions**

**Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions**

**Permanent slide of *Herdmania* spicules**

**2. Agnatha**

*Petromyzon*

**3. Fishes**

*Sphyrna, Pristis, Torpedo, Chimaera, Notopterus, Mystus, Heteropneustes, Labeo, Exocoetus,*

*Echeneis, Anguilla, Tetradon/ Diodon, Anabas, Flat fish*

**TEXT BOOKS:**

1. M .Ekambaranatha Ayyar. 1973A Manual of Zoology Part II .Chordata  
S.Viswanathan Printers and publishers, Pvt.Ltd.,Madras

2. Jordan.E.L and P.S.Verma, 1989. Chordate Zoology and Elements of  
Animal Physiology, S.Chand & Co., Ltd., New Delhi.

3. Jordan E.L and P.S.Varma, 1985. Invertebrate Zoology, S.Chand & Co., New Delhi

4. Young.J.Z, 1988. The Life of Vertebrates. Oxford at the clarendon press,London

5. Adam Sedgwick, 1960. A students Text Book of Zoology Vol.III. General Book  
Depot, Allahabad

6. Hyman.L.H, 1947. Comparative Vertebrate Anatomy. University of Chicago Press  
New York, Chicago.

7. Edwin H Colbert, 1969. Evolution of Vertebrate. Wiley Eastern University, Ansari  
road, New Delhi

**FOURTH SEMESTER**  
**IZOT 43 – Chordata II**

**UNIT I: Amphibia Origin of *Tetrapoda* (Evolution of terrestrial ectotherms)**

**General characters and classification up to order- type study – frog- adaptive features of Anura, Urodela & Apoda. Parental care in Amphibians**

**UNIT II : Reptilia - General characters and classification up to order –Identification of poisonous and non-poisonous snakes of South India- Poison apparatus, Types of fangs, Biting mechanism in snakes – type study - Calotes**

**UNIT III: Aves - General characters and classification up to order-Principles and aerodynamics of flight, Flight adaptations-Flightless birds and their distribution - *Archaeopteryx*- a connecting link-Migration in birds**

**UNIT IV: Mammals General characters and classification up to order; Affinities of Prototheria**

**Adaptive radiation with reference to locomotory appendages- Flying mammals – Dentition in Mammals- Aquatic mammals**

**UNIT V: Zoogeography -Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, Distribution of vertebrates in different realms (Tabular form)**

**PRACTICALS:**

**Amphibia**

*Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra*

**Reptiles**

*Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Draco, Ophiosaurus, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus*

**Key for Identification of poisonous and non-poisonous snakes**

**Aves**

**Study of six common birds from different orders**

**Types of beaks and claws**

**Mammalia**

*Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Hemiecheni*

**FIFTH SEMESTER**  
**IZOT 51 – FUNCTIONAL ANATOMY**

**Objective:**

To learn the functioning of cells and animals

**UNIT I**

Aim and scope of physiology-Biomolecules-carbohydrate-aminoacids, peptids, lipids, proteins, nuclic acids and nucleotides.

**UNIT II**

Nutritional requirements and disorders, Nature of enzymes-digestion-Intra cellular and extracellular digestion-absorption of dietary component(carbohydrate, fats and protein) Metabolism-concept, selected examples, pathways and regulatory features.

**UNIT-III**

Blood-composition and function of blood and lymph; blood groups-blood coagulation, structure and function of haemoglobin-heart-structure-origin-conduction and regulation of heart beat; cardiac cycle and ECG-blood pressure-regulation.

**UNIT IV**

Respiration-mechanism and control of breathing. Structure and function of kidney-physiology of urine formation. Skeletal and smooth muscle function. Brief account of neuronal function.

**UNIT V**

Physiology of neuronal function-Brief account of biological clock

**PRACTICALS:**

1. Ionic regulation of erythrocytes in two different media
2. Estimation of haemoglobin
3. Blood cell count
4. Blood coagulation
5. Qualitative test for sugars
6. Qualitative test for protein
7. Qualitative test for lipids
8. Activity of salivary amylase
9. Recording of heart beat by using kymograph
10. Histology of tissues (Testis, ovary, thyroid gland)

**TEXT BOOKS:**

1. Goel,K.A., K.V.Sastri, 1996. Text Book of Animal Physiology. Rastogi Publication, Meerut
2. Rastogi,S.C , 1992. Essential of Animal Physiology, Second Edition.Wilay Eastern Ltd., New Delhi
3. Prosser.L and B.Brown, 1965. Comparative Physiology. Saunders Company, London.
4. Arora.M.P, 1988. Animal Physiology. Himalaya Pub.House,Bombay
5. Herket,P.C and P.N.Mathur, 1976. Text Book of Animal Physiology. Chand & Co.,(P)Ltd,NewDelhi.

## IZOT 52 - MOLECULAR CYTOGENETICS

### OBJECTIVE:

To Make the understand biology of chromosomes, human cytogenetics, regulation gene expression in Prokaryotes and Eukaryotes, molecular cytogenetics techniques and gene organization

### UNIT I

**Biology of chromosomes: Molecular anatomy of eukaryotic chromosomes-metaphase chromosomes-centromere-kinetochore-telomere and its maintenance-Heterochromatin, Euchromatin-Giant chromosomes; Polytene and lampbrush chromosomes.**

### UNIT II

**Human Cytogenetics: Human genome-Techniques in human chromosome analysis-molecular cytogenetic approach-human karyotype-banding-nomenclature-numerical and structural abnormalities of human chromosomes-syndromes-mendelian and chromosome based heritable diseases in humans**

### UNIT III

**Regulation of Gene Expression in Prokaryotes-induction and repression; details of genes; lac-operon, transcriptional and translational control; regulation in eukaryotes: Britten and Davidson's model; current views on eukaryotic gene regulation**

### UNIT IV

**Molecular cytogenetic technique: FISH-DNA finger printing-automated karyotyping-chromosome painting**

### UNIT V

**Genome Organization: C-value paradox-detailed account of various models of prokaryotic genomes-viral genome and eukaryotic genomes-organization of genes in organelle genomes-transposable elements in prokaryotes and eukaryotes-role of transposable elements in genetic regulation. Microbial genetics: Bacterial transformation-transduction-conjugation-bacterial chromosome-types, structure and morphology of T4 phage.**

### PRACTIALS:

1. Giant chromosomes in Chironomous larva
2. Heterochromatin and euchromatin
3. G-Banding of chromosome-geimsa stain
4. Automated karyotyping (Demonstration)
5. Structure and morphology of Bacteria and T4 phage(Demonstration)
6. Study of metaphase chromosome
7. Karyotyping of human chromosomes (Demonstration)

### TEXT BOOKS:

1. Brooker,R.J. Genetics:Analysis and Principles. Benjamin/cummings,Longman Inc.
2. Fairbanks.D.J and W.R.Anderson.,2000 Genetics-The continuity of Life Brooks/Cole Pub.Co., ITP,New York, Toronto
3. Lewin.B. Genes VII, 2000. Oxford University Press, Oxford, New York
4. Watson.J.D., N.H.Hopkins, J.W.Roberts, J.A.Steity and A.M.Weiner
5. Molecular Biology of Genes. The Benjamin/Cummings Pub Co.Tokyo
6. Klug.S Willam, Cumming.M.R 2000. Concept of Genetics. Prentice Hall. International Inc.New Jersey.
- 7.Atherly,A.G, J.R. Girton and J.F.Mcdonald. The science of Genetics.Saunders College Publishing,Harcourt Brace College Publishers, Newyork
8. Griffiths,A.J.I., J.H.Miller, D.T.Suzuki, R.C. Lewontin of W.M.Gelbart. An Introduction to genetic analysis. W.H.Freeman and Co., New York

## **IZOT 53 - CELLULAR AND MOLECULAR BASIS OF DEVELOPMENT**

### **Objective:**

To understand pattern growth and oncogenesis, physiology organic growth , cell interaction in development, differentiation and genomic equivalence and differential gene expression

### **UNIT I**

Cell theory – structure of prokaryotic and Eukaryotic cells-plasma membrane-cellular organelles- golgi complex, endoplasmic reticulum, mitochondria, ribosomes, nucleus – structure and function.

### **UNIT II**

Patterns of growth and oncogenesis: The mathematics of organismal growth-Growing pains; Physical limits to growth-Isometric growth-Brooks's law of linear growth –the equiangular spiral-allometric growth.

The physiology of organ growth: Growth hormones and mitosis-growth inhibitory factors. Oncogenes and cell growth: Viral oncogenes-oncogenes and cellular growth.

### **UNIT III**

Cell interaction in development; Role of cell surface-differential cell affinity; specific cell affinity-changes and migration in sea urchin embryo-models of cellular migration-chemotaxis, haptotaxis, galvanotaxis, contact guidance, contact inhibition of movement-changing structure of cell surface, cell membrane changes with development; cell adhesion molecules- extra cellular matrix.

### **UNIT IV**

Differentiation-Totipotency, determination and differentiation-totipotentstate-determined state-signals-programming gene expression-genetic mechanism of determination and differentiation cell-transformation reprogramming the genome-somatic cell hydrolysis and gene regulation.

### **UNIT V**

Aging-in population-cellular basis of aging; aging at the organismic level

### **PRACTICALS:**

1. Cell structure – Prokaryotic and Eukaryotic types
2. Study of subcellular organelles
3. Chorio-allantoic graft in chick
4. Cell dissociation
5. Regeneration in amphibians
6. Effect of thyroxine on metamorphosis in frog

### **TEXT BOOKS:**

1. Philip Grant, 1978. Biology of Developing system. Holt Rinehart and Winston, New York, London
2. Scott.F.Gilbert, 1988. Developmental of Biology. Sinauer Associates Inc. publishers-Sunderland , Massachusetts
3. Balinsky,B.I, 1981. An Introduction to Embryology, CBS College Publishing, Holt, Rinehart and Winston-The Dryden Press

## **IZOT – 54 EVOLUTION AND ANIMAL BEHAVIOUR**

**Objective: To make the students to learn the concepts of evolution –polymorphism, polyploidy and animal behaviour**

### **EVOLUTION**

#### **UNIT I**

**Concept of evolution –origin of life- geological time scale-formation and dating of fossils**

#### **UNIT II**

**Theories of organic evolution: Darwinism and Neo - Darwinism; Lamarckism and Neo-Lamarckism; DeVries theory of mutation**

#### **UNIT III**

**Polymorphism-polyploidy-isolation and speciation-mimicry**

#### **UNIT IV**

**Hardy-Weinberg Law of genetic equilibrium-Genetic drift-evolution of horse and man.**

### **ANIMAL BEHAVIOUR**

#### **UNIT V**

**Concept of ethology-motivation-fixed action pattern-kinds of learning imprinting-reproductive behaviour-aggressive behaviour-social organisation-advantages of sociality-the evolution of sociality.**

#### **PRACTICALS**

- 1. Gene frequencies calculation for human autosomal traits and multiple alleles**
- 2. Study of fossils**
- 3. Mimicry**
- 4. Polymorphism**
- 5. Animal adaptation**
- 6. Genetic drift**
- 7. Analogy and homology**

#### **TEXT BOOKS:**

- 1. Stebbins,G.L, 1979. Process of Organic Evolution. Prentice Hall of India, New Delhi**
- 2. Veer Bala Rastogi, 1980. Organic evolution. Kadar Nath, Ram Nath, Meerut**
- 3. Edward.D, Dodson, 1960. Evolution-process and product. Affiliated East West Press Ltd., New Delhi**
- 4. Verma,P.S and Agarwal,V.K, 1998. Principles of evolution. S.Chand and Company Ltd., New Delhi**
- 5. Reha Mathur, 1994. Animal Behaviour. Rastogi and Company Meerut**
- 6. Aubrey Manning, 1967. An Introduction to animal behaviour. Addison-Wesley Publishing Company, London**



**SIXTH SEMESTER**  
**IZOT 61 - COMPARATIVE ANIMAL PHYSIOLOGY**

**Objective:**

The expose the students to the various physiological mechanisms functioning in animal kingdom.

**UNIT I : Aim and scope of comparative physiology**

Aim and scope of comparative physiology- **Feeding and digestion**; food – nutritional types- feeding mechanisms: digestion-intracellular and extracellular- mouth- stomach-dafaecation.

**Absorption**: absorption of carbohydrates- fats- sterols – proteins – salts- mechanism of absorption- faeces.

**UNIT II : Blood and circulatory system**

**Blood and circulatory system**- functions of blood; erythrocytes; leukocytes; blood platelets; plasma – coagulation-volume- transfusion-Heart function – Cardiac cycle- regulation of heart beats- heart sounds – blood pressure.

**Respiration**-respiratory organs and respiratory pigments through different phylogenic groups-metabolic pathways and variations in different phylogenic groups of animals.

**UNIT III : Osmoregulation**

**Osmoregulation** in different animal-patterns of nitrogen excretion among different animal groups (Ammonotelic, ureotelic and uricotelic) circulation of body fluids and their regulation.

**UNIT IV : Osmoregulation**

**Receptor physiology**-a comparative study (Mechano reception, phono reception, photo reception, chemoreception, equilibrium reception) Muscle-structure and function-brief account of amoeboid, ciliary and flagellary movements.

**UNIT V : Osmoregulation**

**Bioluminescence**-Communication among animals-bioluminescence-pheromones-functional regulation of chromatophores system. Colour change in animals.

**PRACTICALS:**

1. **Pattern of osmotic response of Crab in two different media**
2. **Effect of chemical substance on respiratory metabolism of fish**
3. **Comparative study of vertebrate and insect eyes.**
4. **Ciliary mode of feeding in freshwater mussel**
5. **Effect of pH and amount of substrate activity of salivary amylase**
6. **Study of ciliary and amoeboid movements**
7. **Estimation of Nitrogenous waste products in cock-roach and birds**
8. **Estimation of Ammonia, urea and uric acid.**

**TEXT BOOKS:**

1. **Prosser.C.L, 1984. Comparative animal physiology. W.B.Sanders & Co.,**
2. **Eckert.R. Animal Physiology Mechanism and adaptation. W.H.Freeman and company**
3. **Hoar.W.S, 1987. General and comparaive animal physiology. Hall of India Ltd., New Delhi**
4. **Schiemdt-Nielsen. Animal Physiology adoptation and environment. Combridge**
5. **Prosser.C.L. Envionment and Metabolic Physiology. Wiley-Liss, New York**

## IZOT 62 - ECOLOGY

### Objective:

To make the students understand the various concepts of **environment, habitat, and the ecosystem.**

### UNIT I : The Environment

**Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement**

### UNIT II :Ecosystem

**Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).**

### UNIT III : Population ecology

**Characteristics of a population; population growth curves; population regulation; life history strategies ( $r$  and  $K$  selection); concept of metapopulation – demes and dispersal, interdemec extinctions, age structured populations. Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.**

### UNIT IV :Population ecology

**Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.**

### UNIT V :Ecological succession

**Types; mechanisms; changes involved in succession; concept of climax. Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation.**

### PRACTICALS:

1. Study of animal parasites, mutualism/symbiosis
2. Determination of T.D.S
3. Determination of dissolved oxygen
4. Determination of dissolved carbon-di-oxide
5. Determination of salinity
6. Examination of benthos

#### Text books

1. E.P. Odum, 1996. **Fundamental of ecology**, natraj Publishers, Dehradun.
2. K. C. Agarwal. 1989. **Environmental Biology**, Agro Botanical Publishers, Bikaner.
3. P.S. Verma and V.K. Agarwal, 2003. **Environmental Biologhy**, S. Chand Co. New Delhi.
4. U. Kumar and B. Kakrani, 2000. **Water Environment and Pollution**, Agrobios, Jodhpur.

## IZOT 63 -APPLIED ZOOLOGY

### Objective:

To make the students acquire knowledge bioinformatics reproductive technologies, Aquaculture, medical zoology and vermiculture

### UNIT I

**Bioinformatics:** Historical perspective on computer and their applications to biology-Introduction to programming-the internet and the biologists-data bases and information retrieval-genome information.

### UNIT II

**Reproductive Technologies:** Gametes technology-collection and preservation of economically important invertebrates and vertebrates; sperm function tests, semen analyses-embryo sexing-methods and principles

### UNIT III

**Aquaculture:** Types of culture-general culture techniques-pond culture-cage culture-pen culture-polyculture. Integrated fish farming; farm construction and management; Induced breeding-hypophysation technique. Culture of ornamental fishes.

### UNIT IV

**Medical Zoology:** Brief accounts of life history-mode of infection and pathogenesis of organisms with reference to man, prophylaxis and treatment for entamoeba, trypanosoma, Leishmani-Giardia, Trichomonas-plasmodium, Fasciolopsis,shistosoma, anacylostoma, wuchereria; Arthropods and vectors of human diseases-malaria,filariasis, epidemic diseases.

### UNIT V

**Composting-methods, factors affecting composting, vermiculture, vermicomposting practices-methods, advantages.**

### PRACTICALS:

1. Study of permanent slides and specimens of parasitic protozoans, helminths and arthropods.
2. Preparation of blood film, examination of blood parasites; trypanosoma and plasmodium.
3. Hypophysation techniques-location and removal of pituitary; pituitary extract, preparation and preservation
4. Culture method of ornamental fishes
5. Antibiotic assay-streptomycin
6. Wine production by - *Saccharomyces cerevisiae* (yeast)
7. Histology of gametes (Testis and ovary)
8. Semen analysis

### REFERENCE:

1. Chery,T.C. General Parasitology (Academic press)
2. Kettle,D.S. Medical Veterinary Entomology (CAB International)
3. Jelrod,H., Emmets.C.W., Burgus,W.C. 1986. Exotic Tropical Fishes, T.F.H.Publications, USA.
4. Jhingran.V.J, 1991. Fish and Fisheries of India. Hindustan publishing corporation, Delhi (Revised and enlarged 3<sup>rd</sup> Edition)
5. Rathnasamy,G.K 1974. A Hand Book of Medical Entomology and Elements of Parasitology. S.Viswanathan Printers and Pub.Pv.Ltd
6. Shukla.G.S and V.B.Upandhyayi. Economic Zoology, Rastogi Pub.Meerut
7. Edwards,C.A and P.J. Bohlen 1996, Earthworm Ecology, Chapman and Hall, London

## **IZOT 64 - TOOLS AND TECHNIQUES OF BIOLOGY**

### **Objective:**

To acquire knowledge in the application of various tools and techniques in the field of biology.

### **UNIT I**

**Principles and uses of Analytical Instruments:** Balances, pH meter, colorimeter, spectrophotometer, Centrifuges, Spectrofluorometer, ESR and NMR spectrometers. Computer aided techniques for data presentation and data analysis.

### **UNIT II**

**Microscopy and Microbiological techniques:** Principles of light, transmission electron, scanning electron, phase-contrast, fluorescence and confocal microscopes. Media preparation, sterilization, inoculation and growth monitoring.

### **UNIT III**

**Separation Techniques:** Molecular separation by chromatography, electrophoresis and precipitation. Organelle separation by centrifugation. Cell separation by flow cytometry and density gradient centrifugation.

### **UNIT IV**

**Radio Isotope Techniques:** Sample preparation for radio active counting Auto radiography, Liquid scintillation, Radio immuno assay (RIA)

### **UNIT V**

**Special Techniques:** Organ ablations (ovariectomy, adrenalectomy etc) perfusion technique, parabiosis, cryopreservation for cells, tissues and organisms, cryotechniques for microscopy.

### **PRACTICALS:**

1. Identification and working principle of different analytical instruments (pH meter, Colorimeter, spectrophotometer, centrifuges etc.)
2. Study of optical instruments (microscope)
3. Paper chromatography and thin layer chromatography
4. Application of computer in biology
5. Demonstration of perfusion technique
6. Organ ablation (ovariectomy, adrenalectomy etc)
7. Parabiosis
8. Microbial culture technique

### **TEXT BOOKS:**

1. Daniel, M. 1998. Basic Biophysics for Biologists. Agco Botanica. Bikaner India
2. Prakash, M & Arora, C.K 1998. Biochemical Techniques Ammol Publications Pvt Ltd., New delhi
3. Prakash, M & Arora, C.K, 1988. Laboratory culture of animals. Ammol Publications Pvt., Ltd.,
4. Setlow R.B and Pollard E.C, 1962. Molecular Biophysics. Addison-Wesley Publishing company, London
5. Ackema, E. 1962. Biophysical science. Prentice Hall Inc. Englewood Cliffs, America
6. Palanichamy, S and Shanmugavelu, M 1996. Principles of Biophysics. Palani Paramount Publications, Palani.
7. Kwon-Chung, J.K and Bennett, E.J 1992. Medical Mycology. Lea & Febiger, Philadelphia, London.
8. Mahon, R.C and Manuselis, Jr. 1995. Text Book of Diagnostic Microbiology. W.B. Saunders Company, Pennsylvania

**VII SEMESTER  
IZOT 71 DEVELOPMENTAL BIOLOGY**

**Objectives**

To make the students understand the various concepts of development.

**Unit-I: Gametogenesis**

Historical thoughts and concepts, scope of embryology - Gametogenesis - spermatogenesis - Oogenesis - Previtellogenesis - Vitellogenesis: egg membranes.

**Unit-II: Fertilization**

Approach of the sperm to the egg, sperm penetration, essence of activation, acrosome, reaction of the egg, Biochemistry of egg activation- parthenogenesis.

**Unit-III: Beginning of Embryogenesis and aspects of Gastrulation**

Types of eggs, cleavage, laws of cleavage patterns of cleavage, physiological and biochemical changes, Role of egg cortex.

Fatemap, gastrulation, physiology of gastrulation, cell lineage; organizer-concepts-induction process.

**Unit-IV: Embryonic Adaptation, Organ Formation and Differentiation**

Placentation, Types of placenta, physiology of placenta Organogenesis - development of eye. Differentiation - definition: Chemical basis, selective action of genes, changing pattern of protein synthesis, sequence of gene action in development.

**Unit-V: Morphogenetic Processes in the later part of Ontogenesis**

Metamorphosis - hormonal regulation of metamorphosis in Amphibia and Insects.

Regeneration - regeneration of limb in salamander: Stimulation and suppression:

Histological process: polarity and gradients in regeneration.

**Practical**

1. Structure of spermatozoa of fish, frog, chick and mammal
2. Structure of egg in insects, fish, frog, chick and mammal
3. Study of types of cleavage
4. Vital staining of chick blastoderm
5. Analysis of excretory products during chick development
6. Histology of testis showing spermatogenesis
7. Histology of ovary showing oogenesis
8. Regeneration in amphibian
9. Effect of thyroxine on amphibian metamorphosis
10. Study of insect metamorphosis

**Text Books**

1. Varma, P.S., & V.K. Agarwal and B.S. Tyagi 2003. Chordate Embryology. S.Chand & Company Ltd. New Delhi.

**Reference Books**

1. Philips Grant. 1977. Biology of Developing System. University of Oregon.
2. Berill N.J, and G. Karp 1978. Developmental Biology. Tata McGraw-Hill Publishing Co., Ltd., New Delhi.
3. Balinsky B.I., 1981. An Introduction to Embryology. 4<sup>th</sup> Ed. Saunder's College Publishing Ltd., New York.
4. Gilbert. F 1988. Developmental Biology. Sinaver Associates, Inc. Publishers.
5. McElroy W.D and B.Glaus 1958. The Chemical basis of Development. The Johns Hopkins Press, Baltimore.
6. Hopper A.F. & N.H.Hart. 1980. Foundations of Animal Development. Oxford University Press, New York.
7. Rinehart. H and Winston 1957. Vertebrate Embryology. Holt, Rinehart and Winston New York.

## IZOT 72 CELL BIOLOGY

### Objectives

To understand the basic concepts of cell organ structure, function, cell growth, metabolism and diseases.

#### Unit-I: Cell Structure and Plasma Membrane

Structure and organization of bacteria and virus – Difference between prokaryotic and Eukaryotic cells. Plasma membrane – structure – composition – functions.

#### Unit-II: Mitochondria

Structure of mitochondria – Shuttle system – Pasteur's effects – role of mitochondria in metabolism – chemical coupling hypothesis – conformational coupling hypothesis – control of respiratory activity enzyme system.

#### Unit-III: Other Cytoplasmic Organelles

General morphology and function of Golgi complex and lysosome - Secretory cycles, primary and secondary lysosome, structure and functions of endoplasmic reticulum, structural organization and function of Prokaryotic and Eukaryotic ribosome.

#### Unit-IV: Nucleus

Structural organization and functions of nucleus, membrane pore complex and nucleolus - Organization of DNA into chromosome, nucleosome, Solenoid, Loops, rosette coil, chromatid, chromosome, Heterochromatin, Euchromatin, Lampbrush chromosome, Polytene chromosome.

#### Unit-V: Cell Cycle and Cancer

Various stages of cell cycle – regulation of cell cycle – cell cycle and its relation to cancer – characteristics of cancer cells – types of cancer – theories of cancer.

### Practicals

1. Light microscope – components, use and principles
2. Mounting of polytene chromosomes
3. Identification of different stages in meiosis in grasshopper
4. Micrometry (A) Camera Lucida (b) Stage Micrometer (C) Ocular Micrometer
5. Determination of Nucleo - Cytoplasmic index
6. Determination of cell diameter
7. Identification of Cancer tissues
8. Preparation of mitosis in Onion root tip
9. Electrophoretic separation of proteins
10. Identification of different tissues – muscle tissues, skeletal tissues- epithelial tissues – nervous tissue and reproductive tissue

### Text Books

1. De Robertis E.D.D and De. Robertis E.M.F. 1980. Cell and Molecular Biology. Holt – Sanders International (8<sup>th</sup> Edition)
2. Gupta. P.K., 2003. Cell and Molecular Biology Rastogi Publication, Meerut, India.

### Reference Books

1. Karp, G., 1979. Cell Biology. Mc Graw Hill Kogakusha Ltd. Japan.
2. Avers, C.J., 1976. Cell Biology. D.Van Nostrand Co., New York.
3. Watson, J.D., 1977. Molecular Biology of the Gene. 3<sup>rd</sup> edition W.A. Benjamin inc. London.
4. Lehninger, A.L., 1984. Principles of Biochemistry. CBS Publishers and Distributors, New Delhi.
5. Carr, K.E., and P.G.Toner 1982. Cell Structure. Churchill Livingstone, London.
6. Dupraw, E.J., 1968. Cell and Molecular Biology. Academic Press New York.
7. Ambrose, E.J., and D.M.Easty 1970. Cell Biology. Addison, Wesley Publishing Company. London.
8. Watson, D., A. Baker. P. Bell, A.Gann, M.Levine, R.Losick, 2004. Molecular Biology of the Gene. "Peasson Education (Singapore) Pvt. Ltd. India Branch" 482. F.I.E Patpargani Delhi- 110 092.

## IZOT 73 GENETICS

### Objectives

To make the students understand the fundamental concepts of genetics, human health related genetic problems, inborn errors and genetic counselling.

#### Unit-I: Mendel's Laws & Gene Expression

Principles of segregation and independent assortment-deviation from Mendel's findings – the chromosome theory of inheritance –DNA is the genetic material-Tobacco Mosaic Virus-penetrance and expressivity-effect of temperature and light on gene expression-environmental effects and twin studies.

#### Unit-II: Polygenic Inheritance

Polygene concept-mode of inheritance of kernal color in wheat-skin color in man-transgressive variation-heritability-Multiple alleles-ABO blood groups in man-MN blood group-Rh blood group-erythroblastosis foetalis-sickle cell anemia-Thalasemia.

#### Unit-III: Linkage, Crossing over and Gene Mapping

Bateson and Punnett coupling and repulsion concept-Morgan and Bridges theory of linkage and crossing over – chiasma frequency-genetic map-gene mapping in *Drosophila* using three point test cross – interference, Hardy- Weinberg law of genetic equilibrium.

#### Unit-IV: Gene fine structure & Molecular Mechanism of Gene Mutations

Fine structure of gene – 'Lac' and 'his' Operon – Mutable and mutator genes- DNA damage and DNA repair mechanism-point mutation-chemical mutagens-molecular mechanism of gene mutation-mutation and amino acid sequence in protein.

#### Unit-V: Genetics of Human Metabolic Disorders

Garrod's discovery-defects in amino acid, lipid and sugar metabolism – one gene and one enzyme theory – one gene one polypeptide theory – co-linearity of gene and its polypeptide products – chromosomal disorders. Genetic counselling

#### Practicals

1. Experiments on Mendelian inheritance
2. Experiments on polygenic inheritance
3. Human traits survey
4. Gene frequency calculations.
5. Statistical analysis of genetic data using Chi-square test.
6. Human pedigree construction for a family data.
7. Tracing of genes in family pedigree studies
8. Collection and identification of human finger prints
9. Study of hereditary disorders with the aid of chromosome karyotyping
10. Identification of sex and mutant characters in *Drosophila*

#### Text Books

1. Karvita B.Aluwalia 1991 'Genetics' Wiley Eastern Ltd., New Delhi.
2. Robert. H Tamirin 2004 'Principles of Genetics' Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi.

#### Reference Books

1. Sarin,C. 1990 'Genetics'. Tata McGraw-Hill Publishing Co Ltd New Delhi.
2. Gupta, P.K, 1996 'Genetics'. Rastogi publications, Meerut, India.
3. Burns, G.W. and Boltsmo, P.J, 1989 'The Science of Genetics'. Macmillan Publishing Co., New York.
4. Lewin B.J, 1993. Genes Wiley Eastern Ltd., New Delhi.
5. James.D Watson, 1987 'Molecular Biology of Gene'. W.A. Benjamin Inc.
6. Curt Stern, 1983 'The Principle of Human Genetics'. W.H. Freeman & Co., San. Francisco.
7. Demirc, 1950. 'Biology of *Drosophila*'. John Wiley and sons Inc. New York.
8. Verma P.S. and Agarwal V.K. 1998 'Genetics'. S.Chand and Co., New Delhi.
9. Gurbachan S.Miglani-2003 "Advanced Genetics". Narosa Publishing House, New Delhi.
10. Daniel. J. Fairbanks, W.Ralph Anderson – 1999. "Genetics The Continuity of Life". Wadsworth Publishing Com. U.S.A.

**EIGHT SEMESTER  
IZOT 81 ANIMAL PHYSIOLOGY**

**Objectives**

To expose the students to the various physiological mechanisms functioning in animal kingdom.

**Unit-I: Food and Digestion**

Composition of food-classification of nutritive substances-digestion-digestive enzymes-absorption-hormonal control of digestion.

**Unit-II: Excretion and Osmoregulation**

Organs of Excretion in different animal groups – vertebrate kidney – Urine formation – Nitrogenous wastes – Acid base regulation in vertebrate kidney, ion exchange mechanism in fish gills – Hormonal control of kidney function in mammal.

General concepts of osmoregulation – osmoregulation in invertebrates and vertebrates.

**Unit-III: Circulation**

Circulation of the blood – Open and Closed systems – vascular pumps – Arthropod heart – Chambered hearts and booster pumps.

Structure of mammalian heart, origin, conduction and regulations of heart beat – patterns of circulations in the vertebrates – ECG – Composition of blood – clotting mechanism – blood groups – buffer system of blood- circulation of body fluids and their regulations.

**Unit-IV: Respiration**

Respiratory organs and their ventilation – Integumentary respiration – bronchial respiration – lungs – mechanism of respiration in vertebrates – Regulation of breathing – Transport of Oxygen - Respiratory pigments – Bohr's effect – Transport of CO<sub>2</sub> – Haldane's effect.

**Unit-V: Neuromuscular and Receptors**

Structure of neuron-electrical phenomena of nerves-theories of excitation-synaptic transmission-neuroendocrine system - hormones and their functions.

Structure of muscle-chemical - composition – mechanism of muscle contraction-energy for muscle contraction

Mechanoreceptors – chemoreceptors - photoreceptors – phonoreceptors

**Practicals**

1. Activity of salivary amylase.
2. Effect of substrate concentration and activity of salivary amylase
3. Effect of enzyme concentration and activity of salivary amylase
4. Effect of P<sup>H</sup> concentration and activity of salivary amylase
5. Quantitative estimation of proteins.
6. Quantitative estimation of haemoglobin.
7. Counting of blood cells.
8. Identification of blood groups.
9. Oxygen consumption of fish.
10. Effect of thyroxin on the respiratory metabolism of fish.

**Text Books**

1. P.S.Verma, B.S. Tyagi and U.V.Agarwal, 2005. Animal Physiology. S.Chand & Company Ltd, New Delhi.
2. S.T.Rastogi, 1988. Essentials of Animal Physiology. Wiley, Eastern Limited, Madras.
3. Williams S.Hoar, 1966. General and Comparative Physiology. Prentice Hall of India, New Delhi.

**Reference Books**

1. Wilson. A, 1979. Principles of Animal Physiology. Macmillan Publishing Co., Inc. New York.
2. Leon Goldstein, 1977. Introduction to Comparative Physiology. Holt, Rinehart and Winston, New York.
3. Prosser, L. and A. Brown, 1965. Comparative Physiology. Saunders Company, London.



## IZOT 82 MOLECULAR BIOLOGY

### Objectives

To understand the molecular basis of the cell structure, function and to familiarise the recent developments and techniques in the field of molecular biology.

### Unit-I : Structure and properties of DNA

DNA- Primary, Double helical and Alternative double helical structures. Properties of DNA – Denaturation, Renaturation, Hypochromic effect, Melting temperature, Liquid and filter hybridization.

### Unit-II: Replication of DNA

Semi conservative replication – DNA polymerizes in prokaryotes and eukaryotes – Klenow fragment – Processivity – proof reading – Replisome – Leading and lagging strands – SSB protein and Co-operative binding – Okazaki fragment. Mechanism and enzymology of DNA replication.

### Unit-III : Structure and properties of RNA

RNA polymerases in prokaryotes and eukaryotes. Types, structure and functions of RNAs, Transcription in prokaryotes and eukaryotes, 'rho' dependent and independent termination, TATA box and Pribnow box.

### Unit-IV: RNA Processing, Editing and Genetic Code

Processing of mRNA, rRNA, tRNA and splicing mechanisms- RNA editing, Genetic code and its properties – Protein synthesis – Protein secretion and Signal hypothesis.

### Unit-V: Recombinant DNA Technology

Reverse transcription and cDNA synthesis – steps involved in the recombinant DNA technology – gene targeting – apoptosis and cancer role of oncogene in cancer.

### Practicals

1. Identification of drum stick chromosome in human blood
2. Identification of Barr body in buccal epithelial cells
3. G-banding of chromosome – Geimsa stain
4. Mitotic index
5. Localization of DNA
6. Localization of RNA
7. Localization of carbohydrates
8. Localization of protein
9. Estimation of DNA
10. Estimation of RNA.

### Text Books

1. Lodish.H, Berk.A, Zipursky.SL, Matuidaira.P, Baltimore.D and Darnell.J (2000) Molecular Biology of the cell W.H. Freeman and company, New York.
2. Lewin.B, 2000 Gene VII, Oxford University Press, London.

### Reference Books

1. Rastogi S.C, Sharma.V.N. and Tandon.A. 1993. Concepts in Molecular Biology. Wiley-Eastern Ltd, Madras.
2. Klug.W.S. and Cummings, M.R. 2000. Concepts of Genetics. 6<sup>th</sup> Ed. Prentice Hall, Inc. New Jersey.
3. Friedfelder.D 1994 Molecular Biology. 2<sup>nd</sup> Ed. Jones and Bartlett Publishers, Inc.
4. De.Robertis E.D.D and De Roberties E.M.F.1980 Cell and Molecular Biology. Holt Sanders International Edition.
5. Lehninger, Nelson and Cox 1993. Principles of Biochemistry. CBS Publishers New Delhi.
6. Karp.G. 1979. Cell Biology. Mc Graw – Hill Book Company New York
7. Dupraw G.J. 1968. Cell and Molecular Biology. Academic Press, New York.

## IZOT 83 ENVIRONMENTAL BIOLOGY

### Objectives

To make students to realize the structure and function of ecosystem, wealth of our natural resources and conservation measures to be taken and create awareness of the laws governing environment.

### Unit-I: Ecosystem

Composition of atmosphere – structure and stratification of atmosphere - Hydrological cycle-kinds of ecosystem-structure and functions of ecosystem-energy flow in ecosystem-trophic levels

### Unit-II: Natural Resources and Conservation

Types of resources-conventional and non- conventional sources of energy-conservation of soil, land and forest - Deforestation and Afforestation – Conservation strategies (WCS &NCS) - Wild life management in India.

### Unit-III: Air and Water Pollution

Air pollution-types of air pollutants-classification and effect of pollutants on vegetation, farm animals and human health-prevention and control of air pollution.

Water pollution-sources of water pollution-water quality standards – Eutrophication-prevention and control of water pollution.

### Unit-IV: Radiation, Noise and Industrial Pollution

Radiation pollution-sources and effects of ionizing radiation.

Noise pollution – sources of noise pollution – effects of noise pollution – control measures. Pollution control and abatement on cement industry – leather industry – textile industry.

### Unit-V: Environmental Impact Assessment and Law

The objective of Environmental Impact Assessment (EIA) – Environmental Appraised Committee (EAC) – The Environmental Management Plan (EMP) – Control of Environmental pollution through law – Environmental Protection Act (1986).

### Practicals

1. Estimation of dissolved Oxygen.
2. Oxygen sag curve from river.
3. Estimation of dissolved Carbon-di-oxide
4. Estimation of Hydrogen sulphide
5. Estimation of Residual chlorine
6. Estimation of total dissolved Solids
7. Determination of sulphate in water
8. Determination of iron in water
9. Determination of silicate in water
10. Determination of Nitrite/Nitrate in water.

### Text Books

1. Sharma.P.D., 1995. Environmental Biology and Toxicology. Rastogi and Company, Meerut, India.
2. Trivedi P.R.,& Gurdeepraj., 1992. Environmental Biology. Akashdeep Publishing House, New Delhi.
3. Pal, B.P.,1982 Environmental Conservation and Development, Nataraj Publishers, Dehra Dun, India.
4. Agarwal, K.C., 1989. Environmental Biology. Agro Botanical Publishers, India.

### Reference Books

1. Trivedi, P.R.& Gurdeepraj., 1992. Water Pollution. Akashdeep Publishing house, New Delhi.
2. Break Mely, W.1980. Chemicals in the Environment. Marshal Dokker INC Newyork.
3. Irving Sax, N.1974. Industrial Pollution. Van Nostrand Raingold Co., Newyork.
4. Pandey G.N.& G.C.Carney, 1989. Environmental Engineering. Tata McGraw-Hill Publishing Co., Ltd.

**NINTH SEMESTER  
IZOT 91 BIOTECHNOLOGY**

**Objectives**

To make the students to learn the application of scientific and Engineering principles to the processing of materials by biological agents to provide goods and service.

**Unit-I: Basic Biotechnology**

**Definition – Scope – Achievements of Biotechnology – Restriction Enzymes, DNA ligases, polymerase etc. Cloning vehicles – Plasmid Bacteriophage, Cosmids, Yeast plasmids- Genomic DNA libraries, cDNA libraries.**

**Unit-II: Techniques in Biotechnology**

**Southern blotting, Northern blotting, Western blotting, In-situ hybridization DNA sequencing PCR, DNA finger printing, DNA probes, site – directed mutagenesis, particle gun, microinjection, electroporation.**

**Unit-III: Medical Biotechnology**

**Insulin, Somatotrophin, somatostatin, hormone production, vaccines, interferons, gene therapy, monoclonal antibodies, Antenatal diagnosis, Invitro fertilization technology, Human genome project.**

**Unit-IV: Agricultural Biotechnology**

**Micropropagation, protoplast culture, Encapsulated seed, Symbiotic and Non symbiotic nitrogen fixation, Biofertilizers- Mass - production of BGA, VAM Rhizobium culture. Biopesticides-single cell protein-trangenic plants and animals. Mushroom culture.**

**Unit-V: Microbial and Environmental Biotechnology**

**Bioreactor, Growth curve, primary metabolites – Vitamins, alcohols, Secondary metabolites – Antibiotics and Toxins, Microbial enzyme production – amylase. Biomass as a source of energy. Biogas production, Vermicomposting, Microbial leaching. Ethical issues and biosafety regulations, Intelluctual property Right (IPR) and Protection (IPP).**

**Practicals**

1. Methods of sterilization
2. Preparation of culture media and Agar slants
3. Estimation of microflora of milk by MBR test & RESAZURINE Test.
4. C.S. of stem and Root nodule of leguminous plants
5. Conn's direct microscopic count of soil microbial population
6. Standard plate count
7. Antibiotic assay – *Streptomycin*
8. Purification of Bacteria
9. Agarose Gel Electrophoresis
10. Study of Biogas Plant.

**Text Books**

1. Dubey.R.C. 2004. A Text Book of Biotechnology. S.Chand & Co. Ltd. New Delhi.
2. Gupta. R.K. 1996. Elements of Biotechnology. Rastogi & Company, Meerut.

**Reference Books**

1. Kumar .H.D. 1998. A Text Book of Biotechnology. Affiliated East – West press Pvt., New Delhi.
2. Purohit .S.S 2000 Biotechnology, Fundamentals and Application. Agrobios. Jodhpur.
3. Primrose .S.B 1991. Molecular Biotechnology. 2<sup>nd</sup> Edition Blackwell, Oxford.
4. Meyers.R.A., 1995. Molecular Biology and Biotechnology. VCH publishers.

## IZOT 92 IMMUNOLOGY

### Objectives

To make the students aware of the basic principles of immunology and expose to the organs and mechanism of immunity.

### Unit-I: Immune System

Scope of immunology-Humoral and Cell mediated immunity - Innate immunity - Acquired immunity - HLA system - Graft rejection.

### Unit-II: Cells and Organs of the Immune System

'B' lymphocytes-'T' lymphocytes -Antigens presenting cells-Null cells - Mononuclear phagocytic cells - Granulocytic cells-Clonal selection of lymphocytes-Primary lymphoid organs-Secondary lymphoid organs.

### Unit-III: Antigens

Definition-Immunological properties of antigen-Immunogenicity, Antigenicity, Allergenicity, Tolerogenicity.Factors affecting immunogenicity-Foreignness, Molecular size, Chemical composition and Degradability, Adjuvants-Epitopes-Heptens-Mitogens.

### Unit-IV: Antibodies

Basic structure of immunoglobulins - classification - functions of immunoglobulins - antibody diversity.

### Unit-V: Antigen Antibody Interactions

Strength of antigen antibody interactions-Antibody affinity-Antibody avidity-Cross reactivity, Precipitin reaction-Agglutination reaction-Haemagglutinations-RadioImmuno Assay (RIA), Enzyme linked Immunosorbant Assay (ELISA)-western blotting.

### Practicals

1. Preparation of solutions of different normality, molarity, and dilutions.
2. Demonstration of lymphoid organs
3. Cell imprinting of lymphoid organs
4. Histology of lymphoid organs
5. Study of bone marrow cells
6. Identifications of Leucocytes in human blood smear.
7. Differential count of W.B.C. from blood smear preparation
8. Human blood grouping
9. Antigen antibody interaction-immunology
10. Rapid plasma regain (RpR) test for syphilis

### Text Books

1. Joshi K.R.and N.O.Osama. Immunology 4<sup>th</sup> Revised Ed. Agrobotanical publishers, Daryageanj, New Delhi.
2. Roitt., I.M.,1988. Essential Immunology. 6<sup>th</sup> ed. EIBS Blackwell scientific publishers

### Reference Books

1. Coleman M.R., M.F.Lombard, R.E.Sicard., 1992. Fundamental immunology 2<sup>nd</sup> Ed., Wm. C.Brown Publishers.
2. Hood Wood W., Wilson 1984. Immunology 2<sup>nd</sup> Edn. The Benjamin/ Cummings Publishers INC London.
3. Lars .A.Hanson and Hans Wigzell 1985. Immunology 6<sup>th</sup> Edn. Butterworth and co. Publishers
4. Nossal G.J.and G.L.Ada 1971. Antigens Lymphoid Cells and the Immune Response. Academic Press, New York, London
5. Kabat E.A. and M.M.Mayer 1961. Experimental Immunohemistry. Charles C.Thomas Publishers Springfield USA.

## IZOT 93 TOXICOLOGY

### Objectives

To make the students to understand the various types of toxicants and its impact on living organisms.

#### Unit-I: Absorption Distribution and Excretion of toxicants

Definition and scope of toxicology - Chemical interaction - Membrane permeability - Diffusion, filtration and engulfing by cells - absorption - distribution - excretion.

#### Unit-II: Bio-Transformation of Toxicants

Definition - general principles - receptor site - degradation reaction - conjugation - bioactivation - complex nature of bio-transformation - Antidotes - mechanism of antidotal action - assessment of antidotal efficacy.

#### Unit-III: Bio-chemical basis of Toxicology

Mechanism of Toxicity - receptor mediated events - disturbance of excitable membrane function, biochemical process - Ca<sup>+</sup> homeostasis - covalent binding - genotoxicity - Tissue specificity - Target organs - mechanism of action.

#### Unit-IV: Methods of Toxicology

Bio-assay test-single species test-mutli species test - acute toxicity test - subacute toxicity test - chronic toxicity test - determination of LC<sub>50</sub> value - pathological techniques - autopsy and histology - histopathology - histochemistry - cytochemistry - morphometric methods.

#### Unit-V: Chemical and Immuno toxicology

Toxic chemicals: Pesticides - automobile emission - heavymetals - fertilizers - food additives - animal, plant and mushroom toxins

Immunotoxicology - General concepts - lymphocytes - Natural killer cells - macrophages - hypersensitivity reaction - immunosuppression - molecular immunotoxicology.

### Practicals

1. Observation and recording of Behavioural changes of normal and treated fish.
2. Estimation of oxygen consumption of normal and toxicant treated fishes.
3. Analysis of pesticide residues in vegetables by finger printing technique.
4. Estimation of acid and alkaline phosphatase activity of normal and toxicant treated animal tissue.
5. Estimation of SDH activity in liver tissue of normal and malathion treated fish.
6. Estimation of total protein content in the muscle tissue of normal and endosulfan treated fish.
7. Estimation of Glucose and Glycogen level in the liver tissue of normal and Lead treated fish.
8. Estimation of AchE activity in brain tissues of normal and mercury treated mouse.
9. Estimation of GSH level in liver tissue of normal and endrin treated mouse.
10. Determination of cell volume in liver tissue of normal and copper treated fish.
11. Histopathological observation of the following  
1.Liver 2. Kidney 3. Brain 4. Intestine 5. Muscle
12. Determination of LC<sub>50</sub> value of Zinc on fish.

### Text Books

1. Sharma, P.D. 1996 Environmental Biology and Toxicology. Rastroggi Publication, meerut, India.
2. LU, F.C 1985 Basic Toxicology. Hemisphere Publication. Corporation, Washington, N.Y.London
3. Gupta, P.K and salunka, D.K. 1985. Modern toxicology. Vol I and II, Metropolitan, New Delhi.
4. Sood, A. 1999 Toxicology. Sarup & sons, New Delhi.

### Reference Books

1. Butler, G.C. 1978. The Principles of Ecotoxicology Scope. 12, ICSO Scope John wiley and sons, Chicheater.
2. Finney D.J 1971. Probit Analysis, Cambridge University Press.
3. Adrien Albert 1981. Selective Toxicity. University press Cambridge.
4. Gupta, P.K and V.Raviprakash 1988. Advance in Toxicology and Environmental Health. Jagmandar Book Agency, New Delhi.

**TENTH SEMESTER  
IZOT 101: ENTOMOLOGY**

**Objectives**

To understand the insect by study of their morphology, anatomy and physiology of various systems, acquire knowledge of Sericulture, Apiculture, Vector insects and integrated pest management.

**Unit-I: Insect Morphology**

Insect taxonomy upto orders – Salient features with suitable examples of the insect orders – Thysanura, Odonata, Isoptera, Orthoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera and Diptera - Insects collection – Preservation – Identification – insect head – types of antennae – mouth parts and wing venation.

**Unit-II: Insect Physiology**

Structure and physiology of integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive and nervous system.

**Unit-III: Agricultural Entomology**

Insect – pests outbreak – assessment of insect population – Identification, seasonal history, biology, nature of damage and control measures of major pests of paddy, sugarcane, vegetables (Brinjal).

**Unit-IV: Principles and methods of Pest Management**

Principles of Insect control – Prophylactic measures – cultural, mechanical, physical methods – Genetic control and quarantine. Biological control : parasites, Predators and Microbial agents. Chemical methods: Pesticides- general classification – classification based on mode of action, mode of entry and Biopesticides: Integrated Pest Management (IPM) – definition, Integration of methods – potential components – need for IPM and uses.

**Unit-V: Beneficial insects and Vector insects**

Sericulture: biology of silk worm, silk gland, cultivation of mulberry plants, rearing silkworm and uses of silk – Apiculture: types of bees, bee colony, life history, Beekeeping accessories and byproducts of bees and its uses. Useful insects – Biology and control measures of important insect vectors – mosquitoes and houseflies.

**Practicals**

1. Methods of harmful insect collection, preservation and submission of insect box.
2. Identification of at least 10 insects belonging to different orders.
3. Mounting of salivary gland of cockroach, mouth parts of cockroach, housefly, and mosquito.
4. Mounting of different types of antennae and legs of insects, wings and their venation.
5. Demonstration of digestive, reproductive (male and female) and nervous system of insects (Cockroach and Odontopus).
6. Histological slides – T.S. of foregut, midgut and hindgut, T.S of testis, L.S. of ovary and types, T.S. of carpus cardiacum and T.S. of carpus allatum.
7. Life history of silkworm (egg, larva, cocoon and adult).
8. Bee keeping equipments and its accessories.
9. Bioassay of insecticides on insects (LC50)
10. Collection and Identification of medically important arthropods (Mosquitoes, house flies, lice and mites).

**Text Books**

1. **Temphare D.B. 1984. A Text Book of Insect Morphology, Physiology and Endocrinology. S.Chand and Co., New Delhi.**
2. **Chapman R.F. 1982. The Insect Structure and Functions. English Language Book society, Hooder Strongron.**

**Reference Books**

1. **Vasantharaj David.B. and V.V. Ramamurthy (2011). Elements of Economic Entomology, Namrutha publications, Chennai 600 116.**
2. **Temphare, D.B. (2009). Modern Entomology, Himalaya publishing Mumbai.**
3. **Ambrose, Dunston P.,. (2004). The Insects: Structure, function and Biodiversity. Kalyani publishers, Ludhiana – New Delhi – Chennai.**
4. **Chapman, R.F. (2002) The Insect structure and functions. English Languages Book Society, Hooder Strongton.**
5. **Mike, W.,. Service (1999). Medical Entomology for Student, Cambridge Press.**
6. **Nayer, K.K., Ananthakrishnan T.N. and David B.V. General and Applied Entomology. Mc.Grow Hill Publications, New Delhi.**
7. **Rathanswamy, G. K. (1986). AHandbook of Medical Entomology and Elementary Parasitology. S. Viswanathasn Printers & Publishers Pvt. Ltd.**
8. **Srivastava, K.P. (1993). A Text Book of Applied Entomology. Vol I & II Kalyani Publishers, New Delhi.**
9. **P.G. Fenmore, Allaparakash, (1992). Applied Entomology : Wiley Eastern Ltd., Delhi.**
10. **Ullal,. S.R. and M.N. Narasimhanna (1987). Hand book of practical sericulture, Central silk board (Ministry of textiles – Government of India), United Mansion, 39, Mahatma Gandhi road, Bangalore.**

## IZOT 102: FISHERIES AND AQUACULTURE

### Objectives

To make the students to understand the Indian fisheries scenario in relation to world aquaculture and learn culture practices.

### Unit-I: Capture Fisheries

Present status and scope of capture fisheries -commercially important fishes-Food and feeding habits of important edible fishes-Age and growth-Method of age determination - length - weight relationship.

### Unit-II: Culture Fisheries

Present status and scope of culture fisheries- Biology of important cultivable fishes - Marketing of cultured fishes-Major diseases - symptoms and treatments.

### Unit-III: Aquaculture Principles and Practices

Aquaculture - types of culture-fish farm-types of ponds-maintenance and management-eradication of algal bloom-predators - induced breeding-hypophysation -factors of induced spawning - transport of fish seed.

### Unit-IV: Culture Methods

Culture of freshwater prawn - *Macrobrachium*-Marine Prawn *Penaeus monodon*-Pearl oyster-Green Mussel - Sea Weeds - Lobster.

### Unit-V: Fish Harvest Technology

Harvesting methods-handling and preservation-Fishing Gears-Fish preservation-fishery byproducts - marketing and economics.

### Practical

1. Estimation of pH, total hardness, dissolved O<sub>2</sub>, salinity
2. Determination of nitrate, sulphate, phosphate and silicate
3. Identification and biology of important cultivable fishes.
4. Morphology and Morphometry study of fish
5. Types of scales in fishes
6. Analysis of gut content of fish
7. Collection and identification of fish parasites
8. Collection and identification of fish predators
9. Identification of commercially important species
10. Demonstration of Hypophysation technique in fish

### Text Books

1. Pillay T.V.R.1995. Aquaculture Principles and Practices. Fishing News Books, Blackwell Science Ltd., Oxford.
2. Jhingran V.J., 1991. Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.

### Reference Books

1. Santhanam, Sugmaran and P.Natarajan, 1997. Manual of Fresh Water Aquaculture. Oxford and IBH Pub.Co., Ltd., New Delhi.
2. Shanmugam.K, 1990. Fishery Biology and Aquaculture. Leo Pathippagam, Madras - 600 083.
3. Biswas S.P., 1993. Manual of Methods in Fish Biology. South Asian Publishers Pvt. Ltd., New Delhi.
4. Kurian C.V. and V.O. Sebastien 1982. Prawns and Prawn Fisheries of India. Hindustan Publishing Corporation New Delhi.
5. Govindan T.K. 1985. Fish Processing and Technology. Oxford and IBH Pub.Co., Ltd., New Delhi.
6. Srivastava, C.B.L., 1985. A Text book of Fishery Science and Indian Fisheries. Kitab Mahal, Allahabad.



## IZOT 103 : ENDOCRINOLOGY

### Objectives

To make the students to learn the objectives and scope of comparative endocrinology, anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions.

#### Unit-I: Pituitary Gland

General characteristics of hormones-Pituitary gland-structural organization-Pituitary hormones functions - hypothalamic control.

#### Unit-II: Thyroid Gland

Thyroid gland-structural organisation- metabolic effects of thyroid hormone- effects of thyroid on reproduction – Parathyroid – structure – function of parathyroid hormone.

#### Unit-III: Pancreas and Adrenal Glands

Structure of pancreas- function of Insulin and glucagon- Adrenals – structural organization, functions of cortical and medullary hormones.

#### Unit-IV: Vertebrate Reproductive Endocrinology

Structure of mammalian testis and ovary-male and female sex accessory organs-hormones of testis and ovary – estrus and menstrual cycle –hormones of pregnancy – parturition – hormonal control of lactation.

#### Unit-V: Insect and Crustacean Endocrinology

The concepts of neurosecretion – Endocrine system in crustacea – endocrine control of moulting and metamorphosis – Neuroendocrine system in insects- endocrine control of moulting and metamorphosis.

### Practicals

1. Demonstration of endocrine organs in vertebrates
2. Demonstration of reproductive systems in vertebrates
3. Histological study of pituitary, adrenal, testis, ovary, corpus luteum, pancreas and thyroid gland
4. Demonstration of reproductive system in insects
5. Demonstration of neuroendocrine complex in insects.
6. Histology of ovary, accessory glands, corpus allatum and brain in insects
7. Demonstration of Parabiosis in cockroach
8. Demonstration of Ovariectomy in cockroach.
9. Vaginal smear showing various stages of estrus cycles
10. Demonstration – influence of insulin on blood glucose level.

### Text Books

1. Turner C.D, 1966, General Endocrinology. 4<sup>th</sup> Ed, W.B.Saunders Co., London.
2. Bentley P.J., 1985. Comparative Vertebrate Endocrinology. S.Chand and Co.,
3. Barrington E.J.W., 1968. An Introduction to General and Comparative endocrinology. Academic press, London.

### Reference Books

1. Harris.G.W. and B.T.Donovan (Ed) 1968. The Pituitary Gland. Vol.3
2. Williams.R.M, 1974, Text Book of Endocrinology 5<sup>th</sup> Ed.
3. BentleyP.J. 1982. Comparative Vertebrate Endocrinology Cambridge University Press.
4. Michael .P. 1968. Endocrinology and Human Behaviour. Oxford University Press, New York.

**ANCILLARY -I**  
**INTEGRATED M.Sc ZOOLOGY (5 Years) SYLLABUS FOR ANCILLARY PAPER**  
**AZOT 01 – ANCILLARY ZOOLOGY- I (ANIMAL DIVERSITY-I)**

**UNIT-I.**

Principles of classification-salient features and classification upto orders in non-chordates. Protozoa- Type study Entamoeba. Porifera and coelenterata-Type Sycon sponge, Obelia

**UNIT-II**

Platyhelminthes and Nematelminthes-Type study-Planaria- parasitic adaptations. Ascaris-Annelida –Salient features-Type study-Earthworm,. Arthropoda-Salient features

**UNIT-III**

Cockroach- Molluscs-Salient features Type study-Fresh water mussel- torsion in mollusca- Echinodermata-Salient features Asterias-Echinoderm larvae-their significance.

**UNIT-IV**

Origin and salient features of chordates. Agnatha - salient features-Type study-affinities Fishes- parental care ,respiratory organs, migration. Amphibians- parental care

**UNIT-V**

Reptiles-Classification upto orders, extinct reptiles, poisonous snakes of India. Birds-salient features flightless birds - adaptive radiation. Mammals. salient features brief account of monotremes, marsupials - Dentition in mammals.

**PRACTICALS**

1. Examination of paramecium, amoeba, euglena.
2. Study of sycon, hylonema and spongilla from slides and specimens
3. Slides and specimens of hydra, obelia, aurelia, sea-anemone, 4. Slides and specimens of Fasciola and Taenia
5. Slides and specimens of ascaris
6. Cockroach – demonstration and mounts
7. Prawn- demonstration and mounts
- Mounts of Radula, ctenidium
8. Echinoderm -specimen study.
9. Amphibia- museum specimens.
10. Reptiles- museum specimens.
- 11 Aves-mounts and museum specimens.
12. Mammals- museum specimens

**TEXT BOOKS:**

- 1.M.Ekambaranatha Ayyar ,1973 A Manual of Zoology –Part –I, Invertebrata S.Viswanathan(Printers and Publishers)Pvt.Ltd.Madras.
2. Jordon, E.L and P.S .Verma ,1985, Invertebrate Zoology. S.Chand and Co. Ltd.New Delhi
3. M. Ekambaranatha Ayyar ,1973, A Manual of Zoology –Part –I, Invertebrata S. Viswanathan(Printers and Publishers)Pvt.Ltd.Madras.
4. Jordon ,E.L and P.S .Verma ,1985, Invertebrate Zoology. S.Chand and Co. Ltd.New Delhi
5. M .Ekambaranatha Ayyar. 1973A Manual of Zoology Part II .Chordata S.Viswanathan Printers and publishers, Pvt.Ltd.,Madras
- . Young.J.Z, 1988. The Life of Vertebrates. Oxford at the clarendon press,London
6. Adam Sedgwick, 1960. A students Text Book of Zoology Vol.III. General Book Depot, Allahabad

**Ancillary-II**  
**AZOT 02- Ancillary Zoology Paper-II**

**Unit I: Cell Biology**

**Introduction: Microscopy and Cytological techniques. Animal cell - Ultra structure : Plasma membrane - Nucleus - Mitochondria - Ribosomes - Endoplasmic reticulum - Lysosomes - Golgibodies - Centrosomes - Chromosomes. Cancer Biology: Cancer definition - Types of cancer - Management of cancer-Radio therapy-Chemotherapy.**

**Unit II: Human Anatomy**

**Human systems : History - The integumentary - Skeletal - Muscular - Digestive - Respiratory - Circulatory - Lymphatic - Nervous - Sense organs - Endocrine - Excretory - Reproductive.**

**Unit III: Genetics**

**Introduction - Multiple alleles - Quantitative inheritance - Sex determination - Sex linked inheritance - Pleiotropy-Hardy Weinberg law- Population genetics.**

**Unit IV: Developmental Biology**

**Introduction - Types of eggs - Cleavage and types - Frog's egg - Gastrulation in frog embryo - Organogenesis in frog-Developmental stages in eye and heart.**

**Unit V: Origin of life**

**Theories - Geological time scale - Fossils - Extinct animals - Mass extinction-Evidences for evolution-Comparative anatomy-Embryology- Physiology-Vestigial organs-Geographical distribution.**

**Practicals:**

- 1. Study of microscope-Light Microscope**
- 2. Preparation of mitosis in onion root tip**
- 3. Identification of blood group**
- 4. Experiments on mendelian inheritance**
- 5. Experiments in polygenic inheritance**
- 6. Vital staining chick blastodein**
- 7. Study of animal adaptation**

**References:**

- 1. Verma P.S and V. K. Agarwal 1/e Reprint 2002. Concept of Cell Biology, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.**
- 2. Arumugam N. Reprint. 1999. Cell Biology, Saras Publication A R P Camp Rd, Peria vilai, Kottar, Nagercoil - 629 002.**
- 3. Verma P. S. and V. K. Agarwal Reprint 2003. Genetics, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.**
- 4. Ranganathan T. S. 6/e Rev. 2002. A Text book of Human Anatomy, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.**
- 5. Verma P. S. and V. K. Agarwal Reprint 2003. Chordate Embryology, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.**
- 6. Arumugam N. Reprint. 1999. A Text book of Embryology, Saras Publication A R P Camp Rd, Peria vilai, Kottar, Nagercoil - 629 002.**
- 7. Verma P. S. and V. K. Agarwal Reprint 1999. Concept of Evolution, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.**
- 8. Arumugam N. 9/e.1999. Organic Evolution, Saras Publication A R P Camp Rd, Peria vilai, Kottar, Nagercoil - 629 002.**

Optional for students of Zoology Department to be offered in the  
X Semester

**Optional - III**

*IZOT O 105-1 PUBLIC HEALTH AND HYGIENE*

**Objectives**

To make the students aware of public health importance, different diseases, causing organisms to human beings and control measures.

*Unit - I*

**Introduction to important disease to human beings. Mosquito – borne diseases – malaria, filariasis and chikungunya. Morphology, life cycle of vector mosquitoes of Anopheles, Culex and Aedes species and vector management.**

*Unit - II*

**Protozoan and human diseases (Kala-azar, typhoid, amoebic dysentery, cholera, sleeping sickness). Morphology, life cycle and control measures of sand flies, Houseflies and Tsetse fly.**

*Unit - III*

**Protozoan and Human diseases. Life cycle and Public Health Importance of Trypanosomiasis, Leishmaniasis and Trichomoniasis**

**Unit - IV**

**Protozoan and Human diseases. Life cycle and Public Health Importance of Taenia solium, Schistosoma and Ascaris.**

*Unit - V*

**Air, food and water – borne diseases. Air – borne diseases – Tuberculosis, Diphtheria and pneumonia. Food and water – borne diseases – sources of water pollutants – cholera, botulism, shigellosis and typhoid fever. Cancer – sources, different types of tumors and treatment.**

*TEXT BOOK*

1. Rathinasamy G.K., 1974. A Handbook of Medical Entomology and Elementary Parasitology. S. Viswanathan Printers and Publication Pvt., Ltd.
2. Dubey, R.C. and D.K. Maheswari, 2005. A text book of Microbiology, S. Chand & Company Ltd., New Delhi.
3. Gupta, P.K and V. Ramprakash, 1985. Advance in Toxicology and Environmental Health. Jagmender Book GENCY, New Delhi
4. Jordon, E.L. and P.S. Verma, 2005, "Invertebrate Zoology", S. Chand & Company Ltd., New Delhi.
5. Parthiban, M. and B. Vasantharaj David, 2007. "Manual of Household & Public Health pests and their control", Namrutha Publications, Chennai.

*REFERENCE BOOK*

1. Mike, W. Service, 2004. Medical Entomology for students, Cambridge University Press, New York.
2. Ernest Carroll Faust, 1955. Animal Agents & Vectors of Human Disease, Lea & Febiger, Philadelphia.
3. James R. Busvine, 1983. Insects and Hygiene, Chapman and Hall, New York.

**Optional for students of Zoology Department to be offered in the  
X Semester  
Optional - III  
IZOT O 105 -2 ANIMAL SCIENCE**

**Objectives**

To make the students acquire knowledge of the biological diversity and their interspecific relations.

**Unit-I**

Characteristic features of major Invertebrate and Vertebrate phyla. (Protozoa, Porifera, Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca and Echinodermata. Protochordata, Fishes, Amphibia, Reptiles, Birds and Mammals)

**Unit-II**

Arthropods and vectors of human diseases (mosquitoes, lice, House fly and ticks). Mode of transmission of pathogens by vectors: control measures of vectors. Useful insect: silkworm

**Unit-III**

Important human and veterinary parasites (protozoans and helminthes): morphology and life cycle of Ascaris, Wuchereria. Fasciola. Schistosoma Leishmania and plasmodium.

**Unit-IV**

Gametogenesis in animals - Molecular events during fertilization. Cleavage patterns and fate maps- and gastrulation

**Unit-V**

Origin of life-different concepts, Theories of organic evolution. (Darwinism, Neo-Darwinism, Lamarckism and Neo-Lamarckism): speciation.

**TEXT BOOKS**

1. Ekambaranatha Ayyar, M. and T.N.Ananthakrishnan, 1987. A Manual of Zoology. Vol.I (Invertebrata). S.Viswanathan Pvt.Ltd. Chennai.
2. Ekambaranatha Ayyar, M. and T.N.Ananthakrishnan, 1987. A Manual of Zoology. Vol.II (Chordata) S.Viswanathan Pvt. Ltd., Chennai.
3. Rathinaswamy, G.K. 1974. "A Hand Book of Medical Entomology and Elementary Parasitology", S.Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
4. Gupta P.K. 1995 Cytology, Genetics and Evolution. Rastogi Publications Meerut.

**REFERENCE BOOKS**

1. Rober D. Barnes 1994. Invertebrate Zoology. 6<sup>th</sup> ed. Brooks W.B.Saunders company. Philadelphia.
2. Madan Mohan Rao. M. 1999 Applied Entomology. Mittal Publications, New Delhi.
3. Deepak Kumar Verma, 1999 Applied Entomology. Mittal Publications, New Delhi.
4. Balinsky B.I. 1970, An Introduction to Embryology. Saunder's college, publishing Ltd., Tokyo.
5. Diwan, A.P. and N.K.Dhakad 1996. Principles of Developmental Biology. Anmol publications Pvt. Ltd., New Delhi.
6. Veer Bala Rastogi 1989. Organic Evolution. Rastogi and company Meerut.

**Optional-IV**  
**IZOT O 106-1 ANIMAL CULTURE TECHNIQUES**  
(Optional for students of Zoology Department to be offered in the  
X Semester)

**Objectives**

To make the students to understand the methods of vermicomposting and techniques of Sericulture, Apiculture and Aquaculture.

**Unit - I**

**Method of composting - factors responsible for composting -vermicomposting - biofertilizers**

**Unit- II**

**Types of honey bees-bee colony-social life in honey bees-types of beehives and other accessories-uses of honey.**

*Unit - III*

**Silk worm, Bombyx mori - cultivation of mulberry plants-rearing of silkworms-silk production-composition and uses of silk.**

*Unit - IV*

**Types of culture-general culture techniques-induced breeding-culture of edible fishes.**

*Unit - V*

**Ornamental Fish Culture – Angel fish-Fighter fish-Gold Fish-Gurami and Guppies.**

*TEXT BOOK*

1. Vasantaraj David.B and Kumaraswamy.T 1988. Elements of Economic Entomology. Popular Book Depot, Madras.
2. Pillay T.V.R.. 1995 Aquaculture Principles and Practices Fishing. News Books Surverly, England.

*REFERENCE BOOKS*

1. Biswas T.D.and S.Kmukhrjee. Text Book of Soil Science. Tata. McGraw Hill, 1994. New Delhi
2. Agarwal S.C.1994. A Hand Book of fish Farming. Narendra publishing House, Delhi.
3. Axalrod H.Immeris, C.W. Burgens, W.S. 1986, Exoitic Tropical Fishes. T.F.H.Publications U.S.A.

**OPTIONAL-IV**  
**IZOT O 106-2 ENVIRONMENTAL SCIENCE**  
(Optional for students of Zoology Department to be offered in the  
X Semester)

**Objectives**

To make the students to become aware of the environmental problems of pollution, wild life sanctuaries and conservation and environmental educations.

**Unit-I**

**Environment – Atmosphere – Stratification of the atmosphere – light and temperature as ecological factors – Hydrological cycle.**

**Unit – II**

**Environmental education – Definition – Goals, objectives – Guiding Principles – Classification - Formal environmental education – Primary level, Secondary level, Tertiary level – Non Formal environmental education.**

**Unit-III**

**Conventional and Nonconventional Sources of energy – conservation of land and forest – social forestry – World and – National conservation Strategy.**

**Unit-IV**

**Air pollution and its effect on organisms – Water pollution and its effect on organisms – industrial and agricultural wastes – pollution control Board – Regulatory Authorities – Pollution Protection Act.**

**Unit – V**

**Wild life of India – National Parks and Sanctuaries – Endangered Fauna of India – Wild life conservation and Management.**

**TEXT BOOKS**

1. Agarwal K.C., 1989. Environmental Biology. Agro Botanical Publishers, India.
2. Sharma P.D., 1991 Ecology and Environment. 6<sup>th</sup> Ed. Restogi Publication. Meerut.

*REFERENCE BOOKS*

1. Odum, EP. 1971. Fundamentals of Ecology, 3<sup>rd</sup> Ed. W.B.Saunders & Co. Philadelphia
2. Odum. EP. 1983. Basic Ecology. Holt-Saunders International Ed. Japan.
3. Pal B.P., 1982. Environmental Conservation and Development. Nataraj Publishers, Dehra Dun, India.

**(Optional for students of other Departments to be offered in the  
VIII, IX and X Semesters)**

**Optional-I  
IZOT O 85 - ANIMAL CULTURE TECHNIQUES  
(Optional for students of other science departments to be offered in the VIII  
Semester)**

**Objectives**

**To make the students to understand the methods of vermicomposting and techniques of Sericulture, Apiculture and Aquaculture.**

**Unit - I**

**Method of composting - factors responsible for composting -vermicomposting - biofertilizers**

**Unit- II**

**Types of honey bees-bee colony-social life in honey bees-types of beehives and other accessories-uses of honey.**

*Unit - III*

**Silk worm, Bombyx mori - cultivation of mulberry plants-rearing of silkworms-silk production-composition and uses of silk.**

*Unit - IV*

**Types of culture-general culture techniques-induced breeding-culture of edible fishes.**

*Unit - V*

**Ornamental Fish Culture – Angel fish-Fighter fish-Gold Fish-Gurami and Guppies.**

*TEXT BOOK*

- 2. Vasantaraj David.B and Kumaraswamy.T 1988. Elements of Economic Entomology. Popular Book Depot, Madras.**
- 3. Pillay T.V.R.. 1995 Aquaculture Principles and Practices Fishing. News Books Surverly, England.**

*REFERENCE BOOKS*

- 1. Biswas T.D.and S.Kmukhrjee. Text Book of Soil Science. Tata. McGraw Hill, 1994. New Delhi**
- 2. Agarwal S.C.1994. A Hand Book of fish Farming. Narendra publishing House, Delhi.**
- 3. Axalrod H.Immeris, C.W. Burgens, W.S. 1986, Exoitic Tropical Fishes. T.F.H.Publications U.S.A.**



**Optional - II**  
**IZOT O 95 - ENVIRONMENTAL SCIENCE**  
**(Optional for students of other science departments to be offered in the IX Semester)**

**Objectives**

To make the students to become aware of the environmental problems of pollution, wild life sanctuaries and conservation and environmental educations.

**Unit-I**

**Environment – Atmosphere – Stratification of the atmosphere – light and temperature as ecological factors – Hydrological cycle.**

**Unit – II**

**Environmental education – Definition – Goals, objectives – Guiding Principles – Classification - Formal environmental education – Primary level, Secondary level, Tertiary level – Non Formal environmental education.**

**Unit-III**

**Conventional and Nonconventional Sources of energy – conservation of land and forest – social forestry – World and – National conservation Strategy.**

**Unit-IV**

**Air pollution and its effect on organisms – Water pollution and its effect on organisms – industrial and agricultural wastes – pollution control Board – Regulatory Authorities – Pollution Protection Act.**

**Unit – V**

**Wild life of India – National Parks and Sanctuaries – Endangered Fauna of India – Wild life conservation and Management.**

**TEXT BOOKS**

1. Agarwal K.C., 1989. Environmental Biology. Agro Botanical Publishers, India.
2. Sharma P.D.,1991 Ecology and Environment. 6<sup>th</sup> Ed. Restogi Publication. Meerut.

*REFERENCE BOOKS*

1. Odum, EP. 1971. Fundamentals of Ecology, 3<sup>rd</sup> Ed. W.B.Saunders & Co. Philadelphia
2. Odum. EP. 1983. Basic Ecology. Holt-Saunders International Ed. Japan.
3. Pal B.P.,1982. Environmental Conservation and Development. Nataraj Publishers, Dehra Dun, India.

**Optional - III**  
**IZOT O 105 - PUBLIC HEALTH AND HYGIENE**  
**(Optional for students of other science departments to be offered in the**  
**X semester)**

**Objectives**

To make the students aware of public health importance, different diseases, causing organisms to human beings and control measures.

*Unit - I*

**Introduction to important disease to human beings. Mosquito – borne diseases – malaria, filariasis and chikungunya. Morphology, life cycle of vector mosquitoes of Anopheles, Culex and Aedes species and vector management.**

*Unit - II*

**Protozoan and human diseases (Kala-azar, typhoid, amoebic dysentery, cholera, sleeping sickness). Morphology, life cycle and control measures of sand flies, Houseflies and Tsetse fly.**

*Unit - III*

**Protozoan and Human diseases. Life cycle and Public Health Importance of Trypanosomiasis, Leishmaniasis and Trichomoniasis**

**Unit - IV**

**Protozoan and Human diseases. Life cycle and Public Health Importance of Taenia solium, Schistosoma and Ascaris.**

*Unit - V*

**Air, food and water – borne diseases. Air – borne diseases – Tuberculosis, Diphtheria and pneumonia. Food and water – borne diseases – sources of water pollutants – cholera, botulism, shigellosis and typhoid fever. Cancer – sources, different types of tumors and treatment.**

*TEXT BOOK*

6. Rathinasamy G.K., 1974. A Handbook of Medical Entomology and Elementary Parasitology. S. Viswanathan Printers and Publication Pvt., Ltd.
7. Dubey, R.C. and D.K. Maheswari, 2005. A text book of Microbiology, S.Chand & Company Ltd., New Delhi.
8. Gupta, P.K and V.Ramprakash, 1985. Advance in Toxicology and Environmental Health. Jagmender Book GENCY, New Delhi
9. Jordon, E.L. and P.S.Verma, 2005, “Invertebrate Zoology” , S.Chand & Company Ltd., New Delhi.
10. Parthiban, M. and B. Vasantharaj David, 2007. “Manual of Household & Public Health pests and their control”, Namrutha Publications, Chennai.

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1. Mike, W. Service, 2004. Medical Entomology for students, Cambridge University Press, New York.
2. Ernest Carroll Faust, 1955. Animal Agents & Vectors of Human Disease, Lea & Febiger, Philadelphia.
3. James R. Busvine, 1983. Insects and Hygiene, Chapman and Hall, New York.

**Optional - IV**  
**IZOT O 106 - ANIMAL SCIENCE**

(Optional for students of other science departments to be offered in the  
X semester)

**Objectives**

To make the students acquire knowledge of the biological diversity and their interspecific relations.

**Unit-I**

Characteristic features of major Invertebrate and Vertebrate phyla. (Protozoa, Porifera, Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca and Echinodermata. Protochordata, Fishes, Amphibia, Reptiles, Birds and Mammals)

**Unit-II**

Arthropods and vectors of human diseases (mosquitoes, lice, House fly and ticks). Mode of transmission of pathogens by vectors: control measures of vectors. Useful insect: silkworm

**Unit-III**

Important human and veterinary parasites (protozoans and helminthes): morphology and life cycle of Ascaris, Wuchereria. Fasciola. Schistosoma Leishmania and plasmodium.

**Unit-IV**

Gametogenesis in animals - Molecular events during fertilization. Cleavage patterns and fate maps- and gastrulation

**Unit-V**

Origin of life-different concepts, Theories of organic evolution. (Darwinism, Neo-Darwinism, Lamarckism and Neo-Lamarckism): speciation.

**TEXT BOOKS**

5. Ekambaranatha Ayyar, M. and T.N.Ananthakrishnan, 1987. A Manual of Zoology. Vol.I (Invertebrata). S.Viswanathan Pvt.Ltd. Chennai.
6. Ekambaranatha Ayyar, M. and T.N.Ananthakrishnan, 1987. A Manual of Zoology. Vol.II (Chordata) S.Viswanathan Pvt. Ltd., Chennai.
7. Rathinaswamy, G.K. 1974. "A Hand Book of Medical Entomology and Elementary Parasitology", S.Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
8. Gupta P.K. 1995 Cytology, Genetics and Evolution. Rastogi Publications Meerut.

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7. Rober D. Barnes 1994. Invertebrate Zoology. 6<sup>th</sup> ed. Brooks W.B.Saunders company. Philadelphia.
8. Madan Mohan Rao. M. 1999 Applied Entomology. Mittal Publications, New Delhi.
9. Deepak Kumar Verma, 1999 Applied Entomology. Mittal Publications, New Delhi.
10. Balinsky B.I. 1970, An Introduction to Embryology. Saunder's college, publishing Ltd., Tokyo.
11. Diwan, A.P. and N.K.Dhakad 1996. Principles of Developmental Biology. Anmol publications Pvt. Ltd., New Delhi.
12. Veer Bala Rastogi 1989. Organic Evolution. Rastogi and company Meerut.