SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

Three Year B. Sc. Degree Course in

Zoology

Principal Dr. D. K. Mhaske
Chairman,
Board of Studies in Zoology,
Savitribai Phule Pune University, Pune. 411 007
1) **Title of the Course: B. Sc. Zoology**

   **F. Y. B. Sc. Zoology**

   *(To be implemented from Academic Year 2013-14)*

2) **Preamble:**

   The well organized curricula including basic as well as advanced concepts in Zoology from first year to third year shall inspire the students for pursuing higher studies in Zoology and for becoming an entrepreneur and also enable students to get employed in the Biological research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject Zoology.

3) **Introduction:**

   At **first year of under-graduation** the topics related to the fundamentals of zoology, including exposure to diversity in animal groups and industries based on the zoological areas are covered. The practical course is aimed at to equip the students with skills required for animal identification, morphological, anatomical, technical description, classification and also applications of zoology in the various industries.

   At **second year under-graduation**: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. courses based on the content of first year shall be introduced.

   At **third year under-graduation**: Theory and practical courses in each semester shall deal with the further detailed studies of the various disciplines of the Zoology subject and other branches of Zoology such as Genetics, Animal Physiology, Molecular Biology, Biochemistry, Microtechnique, Non-chordate and Chordate, Developmental Biology, Histology, Cell Biology, Biodiversity, Public health and hygiene, Pathology, Entomology, Biotechnology, etc. The students will also learn about use of various technical skills in the biological sciences to be helpful during research in the Zoology subject.

   **Objectives:**

   - To provide thorough knowledge about various animal sciences from primitive to highly evolved animal groups.
   - To make the students aware of applications of Zoology subject in various industries.
   - To highlight the potential of various branches of Zoology to become an entrepreneur.
• To equip the students with skills related to laboratory as well as field based studies.
• To make the students aware about conservation and sustainable use of biodiversity.
• To inculcate interest and foundation for further studies in Zoology.
• To address the socio-economical challenges related to animal sciences.
• To facilitate students for taking up and shaping a successful career in Zoology.

4) Eligibility:

1. **First Year B.Sc.**: A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the Savitribai Phule Pune University, Pune eligibility norms.

2. **Second Year B.Sc.**: Keeping terms of First Year of B. Sc. with zoology as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee by Faculty of Science of the Savitribai Phule Pune University, Pune are also eligible.

3. **Third Year B.Sc.**: Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with zoology as one of the subjects.

*Note:* Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with terms and conditions laid down by the Savitribai Phule University of Pune. Reservation and relaxation will be as per the Government rules.

5 **A) Examination Pattern:**

**First Year B. Sc. Zoology**

Pattern of Examination : Annual  
Theory courses  
Zoology Theory Paper I : Annual  
Zoology Theory Paper II : Annual  
Practical Course  
Annual
<table>
<thead>
<tr>
<th>Paper/ Course No.</th>
<th>Title</th>
<th>Total Number of lectures/practicals per Term</th>
<th>Standard of passing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Internal marks out of 20</td>
</tr>
<tr>
<td>Theory Paper I</td>
<td>Animal Systematics and Diversity -I</td>
<td>Three lectures/Week (Total 36 lectures per term)</td>
<td>8</td>
</tr>
<tr>
<td>ZY-101 (First term)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory Paper I</td>
<td>Animal Systematics and Diversity -II</td>
<td>Three lectures/Week (Total 36 lectures per term)</td>
<td>8</td>
</tr>
<tr>
<td>ZY-101 (Second term)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory Paper II</td>
<td>Fundamentals of Cell Biology</td>
<td>Three lectures/Week (Total 36 lectures per term)</td>
<td>8</td>
</tr>
<tr>
<td>ZY-102 (First term)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory Paper II</td>
<td>Genetics</td>
<td>Three lectures/Week (Total 36 lectures per term)</td>
<td>8</td>
</tr>
<tr>
<td>ZY-102 (Second term)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical Paper III</td>
<td>Practical</td>
<td>9 Practicals of 4 lectures in each term (18 practicals / year)</td>
<td>8</td>
</tr>
<tr>
<td>ZY-103 (First &amp; Second Term)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

**Notes:**

1. Total marks: Theory (100 + 100) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers be given on the basis of internal assessment, tests etc.

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>8 sub-questions, each of 2 marks; answerable in 2-3 lines and based on entire syllabus</td>
</tr>
<tr>
<td>Question 2 and 3</td>
<td>4 out of 6 - short answer type questions; answerable in 8 – 10 lines</td>
</tr>
<tr>
<td>Question 4</td>
<td>2 out of 4 – Descriptive answer type questions, answerable in 15 – 20 lines</td>
</tr>
<tr>
<td>Question 5</td>
<td>1 out of 2 – Descriptive answer type questions, answerable in 35 – 40 lines</td>
</tr>
</tbody>
</table>
**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks in each term. The written test shall comprise objective type questions – Multiple choice questions, True / False, Definitions, Answer in one or two line questions. There shall be 20 questions.

Practical: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05.

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory for appearing in practical examination. There shall be two expert and two examiners per batch for the practical examination.

**Second Year B. Sc. Zoology**

*(To be implemented from academic year 2014-2015)*

Pattern of examination: Semester

Theory courses: Sem I: ZY-211 and ZY-212: Semester

Sem II: ZY-221 and ZY-222: Semester

Practical Course: Annual

<table>
<thead>
<tr>
<th>Paper/Course No.</th>
<th>Title</th>
<th>Total Number of lectures/practicals per Term</th>
<th>Internal marks out of 10 (Theory)</th>
<th>External marks out of 40 (Theory)</th>
<th>Total passing marks out of 50 (Theory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZY-211</td>
<td>Animal Systematics and Diversity -III</td>
<td>Four lectures/Week (Total 48 per semester)</td>
<td>4</td>
<td>16</td>
<td>20*</td>
</tr>
<tr>
<td>ZY-212</td>
<td>Applied Zoology I</td>
<td>Four lectures/Week (Total 48 per semester)</td>
<td>4</td>
<td>16</td>
<td>20*</td>
</tr>
<tr>
<td>ZY-211</td>
<td>Animal Systematics and Diversity -IV</td>
<td>Four lectures/Week (Total 48 per semester)</td>
<td>4</td>
<td>16</td>
<td>20*</td>
</tr>
<tr>
<td>ZY-212</td>
<td>Applied Zoology II</td>
<td>Four lectures/Week (Total 48 per semester)</td>
<td>4</td>
<td>16</td>
<td>20*</td>
</tr>
<tr>
<td>ZY-223 (Semester- I and II)</td>
<td>Paper III Practical course</td>
<td>12 Practicals of 4 lectures in each Semester (24 practicals / year)</td>
<td>8</td>
<td>32</td>
<td>40**</td>
</tr>
</tbody>
</table>
Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:
1. Total marks: Theory for each semester (50 + 50) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Internal marks for Practical Course should be a regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05.

Theory examination will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks as follows: The pattern of question papers shall be:

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>10 sub-questions, each of 1 marks based on entire syllabus</td>
<td>10 marks</td>
</tr>
<tr>
<td>Question 2 and 3</td>
<td>2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10-15 lines</td>
<td>10 marks each</td>
</tr>
<tr>
<td>Question 4</td>
<td>1 out of 2 sub-questions, each of 10 marks; long answer type questions (20-25 lines)</td>
<td>10 marks</td>
</tr>
</tbody>
</table>

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple choice Questions, True / False, Definitions and Answer in Two or three lines. There shall be 20 questions.

Practicals: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05

Practical Examination: Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory for appearing in practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.
### Third Year B. Sc. Zoology

*(To be implemented from academic year 2015-2016)*

Pattern of examination: Semester

Theory courses: (Sem III: ZY-331 to ZY-336) : Semester
(Sem IV: ZY-341 to ZY-346) : Semester

Practical Course: (ZY-347-349) : Annual

<table>
<thead>
<tr>
<th>Paper/Course No.</th>
<th>Title</th>
<th>Total Number of lectures Per Semester</th>
<th>Standard of passing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Internal marks out of 10 (Theory) out of 20 (Practical)</td>
</tr>
<tr>
<td><strong>SEM III</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZY-331</td>
<td>Animal Systematics and Diversity V</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-332</td>
<td>Mammalian Histology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-333</td>
<td>Biological Chemistry</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-334</td>
<td>Environmental Biology and Toxicology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-335</td>
<td>Parasitology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-336</td>
<td>General Pathology or Cell Biology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td><strong>SEM IV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZY-341</td>
<td>Biological Techniques</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-342</td>
<td>Mammalian Physiology and Endocrinology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-343</td>
<td>Genetics and Molecular Biology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-344</td>
<td>Organic Evolution</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-345</td>
<td>General Embryology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>ZY-346</td>
<td>Public Health and Hygiene or Medical Entomology</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>Practical Papers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td></td>
</tr>
</tbody>
</table>
| **ZY- 347**  
(Semester III & IV) | Practical Paper I | Practicals related to ZY-331, ZY-332, ZY-341, ZY-342.  
12 Practicals of 4 lectures in each Semester (24 Practicals / year) | 8 | 32 | 40** |
| **ZY- 348**  
12 Practicals of 4 lectures in each Semester (24 Practicals / year) | 8 | 32 | 40** |
| **ZY- 349**  
12 Practicals of 4 lectures in each Semester (24 Practicals / year) | 8 | 32 | 40** |

* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

** Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

**Notes:**
1. Total marks: Theory for each semester (50 × 6 ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Practicals: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05.

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying 10 marks. The pattern of question papers shall be:

| Question 1 | 10 sub-questions, each of 1 marks based on entire syllabus | 10 marks |
| Question 2 and 3 | 2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines | 10 marks each |
| Question 4 | 1 out of 2 sub-questions, each of 10 marks; long answer type questions (20 – 25 lines) | 10 marks |
**Internal examination**: Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple choice questions, True / False, Definitions, Answer in Two or three line questions. There shall be 20 questions.

Practicals: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks for experimental skills: 05.

**Practical Examination**: Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

5 B) **Standard of Passing**:

i) In order to pass in the first year theory examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Theory Examination.)

ii) In order to pass in the Second Year and Third Year theory examination, the candidate has to obtain 20 marks out of 50 in each course of each semester. (Minimum 16 marks out of 40 must be obtained in the University Theory Examination.)

iii) In order to pass in practical examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Examination.)

5 C) **ATKT Rules**:

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed while going to T.Y.B.Sc.

While going from S.Y.B.Sc. to T.Y.B.Sc., at least 12 courses (out of 20) should be passed (Practical Course at S.Y.B.Sc. is equivalent to 2 courses).

5 D) **Award of Class**:

The class will be awarded to the student on the aggregate marks obtained during the second and third year in the principal subject only. The award of the class shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Aggregate</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70% and above</td>
<td>First Class with Distinction</td>
</tr>
<tr>
<td>2</td>
<td>60% and more but less than 69%</td>
<td>First Class</td>
</tr>
<tr>
<td>3</td>
<td>55% and more but less than 59%</td>
<td>Higher Second Class</td>
</tr>
<tr>
<td>4</td>
<td>50% and more but less than 54%</td>
<td>Second Class</td>
</tr>
<tr>
<td>5</td>
<td>40% and more but less than 49%</td>
<td>Pass Class</td>
</tr>
<tr>
<td>6</td>
<td>Below 40%</td>
<td>Fail</td>
</tr>
</tbody>
</table>
5  E) External Students:
There shall be no external students.

5  F) Setting of question papers:

   F. Y. B. Sc.: For theory papers I and II annual question papers shall be set by the University of Pune and assessment shall be done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

   S. Y. B. Sc. and T. Y. B. Sc.: For theory papers for each semester and also for the annual practical examination, question papers shall be set by the University of Pune. Centralized assessment for theory papers shall be done as per the University instructions. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, papers shall be set by the University of Pune and assessment shall be done by the internal examiner and external examiner appointed by University of Pune.

5  G) Verification and Revaluation Rules:

As per University Statues and Rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

6  Course Structure:

   Duration: The duration of B.Sc. Zoology Degree Program shall be three years.

   a) Compulsory Papers:

   F. Y. B. Sc.: 2 Theory + 1 Practical (Annual)

   S. Y. B. Sc.: 2 Theory per semester + 1 Practical (Annual)

   T. Y. B. Sc.: 6 Theory per semester + 3 Practical (Annual)

   b) Question Papers:

   F. Y. B. Sc. Theory paper:

   University Examination – 80 marks (at the end of 2$^{nd}$ term)

   Internal Examination – 20 marks

   S. Y. / T. Y. - B. Sc. Theory paper:

   University Examination – 40 marks (at the end of each term)

   Internal Examination – 10 marks

   F. Y. / S. Y. / T. Y. - B. Sc. Practical Paper:

   University Examination – 80 marks (at the end of 2$^{nd}$ term)
Internal Examination – 20 marks

**Medium of Instruction:** The medium of instruction for the course shall be **English**.

7 **Equivalence of Previous Syllabus:**

**F.Y.B.Sc. :-**

<table>
<thead>
<tr>
<th>Old Course (2008 Pattern)</th>
<th>New Course (2013 Pattern)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper I: Nonchordates and Chordates</td>
<td>Animal Systematics and Diversity –I and II</td>
</tr>
<tr>
<td>Paper II: Genetics and Parasitology</td>
<td>Fundamentals of Cell Biology and Genetics</td>
</tr>
<tr>
<td>Paper III: Practical course</td>
<td>Paper III: Practical course</td>
</tr>
</tbody>
</table>

**S.Y.B.Sc. :-**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester-II</td>
<td>Paper I: General Zoology and Biological Techniques-II</td>
<td>Paper I: Animal Systematics and Diversity –IV</td>
</tr>
<tr>
<td>Annual Examination</td>
<td>Paper III: Practical course</td>
<td>Paper III: Practical course</td>
</tr>
</tbody>
</table>

**T.Y.B.Sc. :-**

**Semester- III**

<table>
<thead>
<tr>
<th>Papers in Old Course (2010 Pattern)</th>
<th>Equivalent papers in new Course (2015 Pattern)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZY-331 General Zoology</td>
<td>ZY-331 Animal Systematics and Diversity V</td>
</tr>
<tr>
<td>ZY-332 Mammalian Histology</td>
<td>ZY-332 Mammalian Histology</td>
</tr>
<tr>
<td>ZY-333 Biological Chemistry</td>
<td>ZY-333 Biological Chemistry</td>
</tr>
<tr>
<td>ZY-334 Environmental Biology and Toxicology</td>
<td>ZY-334 Environmental Biology and Toxicology</td>
</tr>
<tr>
<td>ZY-335 Any one of the following a. Basic Entomology b. General Pathology</td>
<td>ZY-335 Parasitology</td>
</tr>
<tr>
<td>ZY-336 Cell Biology</td>
<td>ZY-336 Any one of the following a. General Pathology b. Cell Biology</td>
</tr>
</tbody>
</table>
### Semester-IV

<table>
<thead>
<tr>
<th>Papers in Old Course (2010 Pattern)</th>
<th>Equivalent papers in new Course (2015 Pattern)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZY-341 Biotechnology</td>
<td>ZY-341 Biological Techniques</td>
</tr>
<tr>
<td>ZY-342 Mammalian Physiology and Endocrinology</td>
<td>ZY-342 Mammalian Physiology and Endocrinology</td>
</tr>
<tr>
<td>ZY-343 Molecular Biology</td>
<td>ZY-343 Genetics and Molecular Biology</td>
</tr>
<tr>
<td>ZY-344 Organic Evolution</td>
<td>ZY-344 Organic Evolution</td>
</tr>
<tr>
<td>ZY-345 Any one of the following</td>
<td></td>
</tr>
<tr>
<td>a. Biodiversity</td>
<td></td>
</tr>
<tr>
<td>b. Public Health and Hygiene</td>
<td>ZY-345 General Pathology</td>
</tr>
<tr>
<td>ZY-346 Genetics and Developmental Biology</td>
<td>ZY-346 Any one of the following</td>
</tr>
<tr>
<td></td>
<td>a. Public Health and Hygiene</td>
</tr>
<tr>
<td></td>
<td>b. Medical Entomology</td>
</tr>
<tr>
<td>ZY-347 Practical I</td>
<td>ZY-347 Practical I</td>
</tr>
<tr>
<td>ZY-331, ZY-332, ZY-341, ZY-342</td>
<td>ZY-331, ZY-332, ZY-341, ZY-342</td>
</tr>
<tr>
<td>ZY-348 Practical II</td>
<td>ZY-348 Practical II</td>
</tr>
<tr>
<td>ZY-349 Practical III</td>
<td>ZY-349 Practical III</td>
</tr>
<tr>
<td>ZY-335, ZY-336, ZY-345, ZY-346</td>
<td>ZY-335, ZY-336, ZY-345, ZY-346</td>
</tr>
</tbody>
</table>

8 **University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

9 **Qualification of Teachers:** M.Sc. Zoology or equivalent master degree in science with class/grades and NET/SET/Ph.D. as per prevailing rules and regulations laid down by University/Government/UGC.
SAVITRIBAI PHULE PUNE UNIVERSITY
BOARD OF STUDIES IN ZOOLOGY

Revised Syllabus for T. Y. B. Sc. (Zoology) to be implemented from June, 2015

**Semester-III:-**
- ZY-331: Animal Systematics and Diversity V
- ZY-332: Mammalian Histology
- ZY-333: Biological Chemistry
- ZY-334: Environmental Biology and Toxicology
- ZY-335: Parasitology
- ZY-336: General Pathology or Cell Biology

**Semester-IV:-**
- ZY-341: Biological Techniques
- ZY-342: Mammalian Physiology and Endocrinology
- ZY-343: Genetics and Molecular Biology
- ZY-344: Organic Evolution
- ZY-345: General Embryology
- ZY-346: Public Health and Hygiene or Medical Entomology
- ZY-347: Practical I- ZY-331, ZY-332, ZY-341, ZY-342
- ZY-348: Practical II- ZY-333, ZY-334, ZY-343, ZY-344
- ZY-349: Practical III- ZY-335, ZY-336, ZY-345, ZY-346
SAVITRIBAI PHULE PUNE UNIVERSITY
BOARD OF STUDIES IN ZOOLOGY
COURSE STRUCTURE OF UNDERGRADUATE CLASSES
(To be implemented from June 2015)

Class: F.Y. B. Sc.

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Prin. (Dr) D. K. Mhaske
Chairman, B.O.S. in Zoology
Savitribai Phule Pune University, Pune
T. Y. B. Sc. Zoology
Zy- 331 (Paper I)
Animal Systematics and Diversity- V

Total lectures: 48

1 Study of *Pila globosa* with reference to the following: 12
   1.1 Systematic position, habit, habitat and external characters
   1.2 Body wall & pallial complex
   1.3 Functional anatomy: digestive, respiratory, circulatory, excretory, reproductive, nervous system & sense organs

2 Study of the following groups with reference to: 08
   2.1 Protozoa : locomotion & nutrition
   2.2 Porifera : skeleton and canal system
   2.3 Coelenterata : polymorphism and corals
   2.4 Hemichordata : affinities

3 Study of *Calotes versicolor* with reference to the following : 14
   3.1 Systematic position, habit, habitat and External characters
   3.2 Functional Anatomy - Digestive, Circulatory, Excretory, Reproductive, Nervous system and Sense organs

4 Comparative study of following topics in vertebrates 08
   4.1 Integument: Skin of *Scoliodon*, Frog, *Calotes*, Pigeon & Rat
   4.2 Heart: Structure of heart of *Scoliodon*, Frog, *Calotes*, Pigeon & Rat
   4.3 Kidney: Evolution of Archinephros, Pronephros, Mesonephros, Metanephros
   4.4 Brain: Morphological variation in the different regions of the brain of *Scoliodon*, Frog, *Calotes*, Pigeon and Rat/Rabbit

5 Study of following groups with reference to 06
   5.1 Pisces : Dipnoi, Accessory respiratory organs , Electric organs
   5.2 Reptilia : Temporal vacuities, General characters of Rhyncocephalia
   5.3 Mammalia : Dentition in mammals
Reference Books


1 Introduction
   1.1 Definition and scope

2 Tissues:
   2.1 Definitions and review of tissues (location, structure and functions): epithelial, connective, nervous and muscular

3 Histological study of following organs
   3.1 Skin (V.S.)
   3.2 Tooth (V.S.)
   3.3 Tongue (C.S.) with reference to mucosa papillae and taste buds
   3.4 Alimentary canal: Basic histological organization with reference to: Oesophagus (T.S.), stomach (T.S.), duodenum (T.S.) Ileum (T.S.) and rectum (T.S.)
   3.5 Glands associated with digestive system: Salivary glands – parotid (C.S.), submandibular (C.S.) sublingual (C.S.), liver (C.S.) and pancreas (C.S.) including both exocrine and endocrine components
   3.6 Respiratory organs: Trachea (T.S.) and lung (C.S.)
   3.7 Blood vessels: Artery (T.S.), vein (T.S.) and capillaries (T.S.)
   3.8 Kidney (L.S.), Structure of nephron and juxtaglomerular complex
   3.9 Reproductive organs:
      a) Testis (T.S.) with reference to Seminiferous Tubules and cells of Leydig
      b) Ovary (C.S.) - primary, secondary and matured (Graffian) follicle, corpus luteum and corpus albicans

4 Histology of endocrine glands:
   4.1 Pituitary gland
   4.2 Thyroid gland
   4.3 Adrenal gland
Reference Books


1. **Basic Biochemistry:**
   1.1 Bonds –Types: Ionic, covalent, noncovalent bonds (hydrogen, hydrophobic, electrostatic, Van der Waal forces) and their functions in bio molecules
   1.2 Structure of water molecule (liquid, ice and colloid)
   1.3 Physico-chemical properties of water
   1.4 Concept of acid and base, pH, Sorenson’s scale, derivation of Henderson Hasselbalch equation and its applications
   1.5 Concept of Buffer-types of buffer, buffering capacity and buffers in biological system (Phosphate, bicarbonate)

2. **Carbohydrates:**
   2.1 Definition and classification of carbohydrates
   2.2 Isomerism in carbohydrates- Structural and stereoisomerism
   2.3 Stereo chemical properties-enantiomers, anomers, epimerism, mutarotation, racemisation, biological significance and clinical significance-hypoglycemia and hyperglycemia

3. **Proteins:**
   3.1 Essential and non essential amino acids
   3.2 Structure and classification of amino acids, Peptide bond, types of proteins, protein structures (primary, secondary, tertiary and quaternary structures with suitable example), bonds responsible for protein structures and Biological significance of proteins

4. **Enzymes:**
   4.1 Classification and properties of enzymes
   4.2 Regulatory and non regulatory enzymes
   4.3 Enzyme kinetics, MM equation and its importance and LB plot
   4.4 Reversible and irreversible enzyme inhibition
   4.5 Factors influencing enzyme activity (pH, temperature, substrate concentration, enzyme concentration)
   4.6 Introduction of isoenzymes, allosteric enzymes, immobilized enzymes and ribozymes
   4.7 Clinical significance of enzymes- PKU and AKU
5. Lipids:

5.1 Introduction, classification and chemistry
5.2 Clinical significance (obesity, atherosclerosis, myocardial infarction)
5.3 Biological significance of lipids

Reference books

2. Biochemistry, 1995 5th Edn. Zuby G. Wm, C.Brown Communications USA
1 Environmental Biology
   Introduction- Definition, basic concepts and scope

2 The Ecosystem
   2.1 Definition, abiotic and biotic components and their interrelationship
   2.2 Energy flow in ecosystem and flow models
   2.3 Major Ecosystems: (a) natural ecosystem: e.g. fresh water, forest (b) artificial ecosystem: e.g. cropland
   2.4 Food chain in ecosystem and food web
   2.5 Ecological pyramids

3 Environmental Pollution:
   3.1 Definition and types of pollution
   3.2 Pollutants, types of pollutants (metallic, gaseous, acids, alkalis, biocides)
   3.3 Air pollution: Definition, sources of air pollution and their effects
   3.4 Air pollution and its relevance with the following
      3.4.1 Acid rain
      3.4.2 Greenhouse effect
      3.4.3 Ozone layer depletion
   3.5 Water pollution: definition, sources of water pollution and their effects on ecosystem.
      Community waste with reference to following:
      I. Sewage
      II. Industrial wastes
      III. Agricultural wastes
   3.6 Land / Soil pollution: definition, sources of land / soil pollution and their effects
   3.7 Noise pollution: definition, sources of noise pollution and their effects and control measures

4 Environment and Development
   4.1 Bioindicators and environmental monitoring
   4.2 Environmental challenges in India: land degradation, population explosion, urbanization and industrialization
5 Natural Resources and Conservation:

5.1 Renewable and non-renewable resources
5.2 Soil conservation
5.3 Forest conservation
5.4 Energy sources: conventional and non-conventional

6 Wildlife Management:

6.1 Definition, causes of wildlife depletion
6.2 Importance of wildlife management in India
6.3 Endangered species, vulnerable species, rare species and threatened species
6.4 Wildlife conservation

7 Toxicants and Toxicity:

7.1 Definition of toxicology, scope and branches
7.2 Types of toxicants
7.3 Factors influencing toxicity (pH, temperature, reproductive status, age, physiological state)
7.4 Dose, LD$_{50}$, LC$_{50}$

8 Toxicants of Public Health and Hazards:

Pesticides, heavy metals, fertilizers, food additives and radioactive substances

Reference Books

1 **Introduction:** Scope and branches of Parasitology
   - Definition: host, parasite, vector, commensalisms, mutualism and parasitism
   
2 **Types of parasites:** ectoparasites, endoparasites and their subtypes
   
3 **Types of hosts:** intermediate and definitive, paratenic, reservoir
   
4 **Host-Parasite relationship:** Host specificity- definition, structural specificity, physiological specificity and ecological specificity
   
5 **Study of the following parasites** with reference to habit, habitat, Life cycle, Mode of Infection, pathogenicity and control measures - *Plasmodium vivax*, *Entamoeba histolytica*, *Ascaris lumbricoides* and *Taenia solium*
   
6 **Study of the following parasites** with reference to morphology, life cycle, pathogenicity and control measures: Head louse, Tick, Mite (*Sarcoptes scabei*)
   
7 **Parasitological significance of Zoonosis:** Bird flu, Rabies and Toxoplasmosis
   
8 **Control measures of arthropod vectors of human diseases:** Malaria (*Anopheles stephensi, A culicifacies*), Dengue, Haemorrhagic fever (*Aedes aegypti, A. albopictus*), Filariasis (*Culex pipiens fatigans*)
   
9 **Epidemic diseases:** Typhoid, Cholera, Small pox; their occurrence and eradication programmes

**Reference Books**

2. Parasites and parasitism, Cameron, 1958, T. W. M. Methuen, London
4. Parasitology and Helminthology in relation to Clinical Medicine, 1980, Edn.12 Chatterjee, K.D., Chatterjee Medical publishers, Calcutta.
11. Parasites: Lice, Ticks & Fleas (Free Kindle), 2014, C.D. Shelton
1 Introduction:
   1.1 Definition, scope and basic branches
   1.2 Applied pathology- biopsy and surgery
   1.3 Autopsy- post mortem changes

2 Clinical pathology
   2.1 Definition and scope
   2.2 Gastric analysis
   2.3 Urine examination
   2.4 Importance of CSF examination
   2.5 Liver function test
   2.6 Renal function test

3 Diseases:
   3.1 Definition and causes
   3.2 Infectious diseases: aetiology and infectious agents

4 Retrogressive changes:
   Definition, cloudy (changes) swelling, degeneration, fatty degeneration, mucoid degeneration and amyloid degeneration

5 Necrosis:
   5.1 Definition and causes
   5.2 Nuclear and cytoplasmic changes
   5.3 Types of necrosis

6 Gangrene:
   6.1 Definition and causes
   6.2 Types: dry, moist and gas gangrene

7 Circulatory disturbances:
   7.1 Hyperemia: active and passive (causes and effects)
   7.2 Ischaemia: causes and effects
   7.3 Hemorrhage: causes, effects and hemorrhagic effects
7.4 Thrombosis: thrombus formation, its causes and effects
7.5 Embolism: Definition, sources, types and effects

8 Inflammation:
  8.1 Definition and causes, cardinals of inflammation (signs), vascular phenomenon and cellular response
  8.2 Acute and chronic inflammation

9 Repair:
  9.1 Process of Repair
  9.2 Types: by regeneration, by connective tissue proliferation
  9.3 Healing: primary and secondary

10 Neoplasia:
  10.1 Definition, causes and types of tumours-benign and malignant
  10.2 Leukemia: acute and chronic.

11 Disorders of pigmentation:
  Brief idea about normal process of pigmentation, melanosis and jaundice

12 Disorders of mineral metabolism:
  Mechanism of calcification, pathological calcification (dystrophic and metastatic) causes and its effects. Gout aetiology and pathogenesis
Reference Books

Introduction to Cell Biology: 3

1.1 Definition and scope
1.2 Prokaryotic and eukaryotic cell: size, shape and structure

Plasma membrane: 6

2.1 Unit membrane concept
2.2 Models: Lipid membrane, Protein-Lipid (Danielli-Davson) and Fluid Mosaic
2.3 Membrane receptors
2.4 Membrane transport: Passive and Active
2.5 Exocytosis and Endocytosis (Phagocytosis and Pinocytosis)

Endoplasmic reticulum: 5

3.1 Occurrence and ultrastructure
3.2 Type: smooth and rough
3.3 Functions

Golgi complex: 3

4.1 Origin, occurrence and morphology
4.2 Ultrastructure and functions

Lysosomes: 3

5.1 Origin, occurrence and morphology
5.2 Ultrastructure, polymorphism and functions

Mitochondria: 4

6.1 Origin, occurrence and morphology
6.2 Ultrastructure and functions (explanation of the cycles not expected)

Nucleus: 6

7.1 Shape, Size, number and position
7.2 Ultrastructure of nuclear membrane and pore complex
7.3 Nucleolus: general organization, chemical composition and functions
7.4 Nuclear sap/ nuclear matrix
7.5 Nucleocytoplasmic interactions
8 **Cytoskeleton:**
   8.1 Microfilaments: location, ultrastructure, biochemical composition and functions
   8.2 Intermediate Filament: location, ultrastructure, biochemical composition and functions
   8.3 Microtubules: location, ultrastructure, biochemical composition and functions

9 **Cell cycle and cell division:**
   Various phases of cell cycle, mitosis, meiosis & role of centriole in the cell division

10 **Cellular ageing and cell death:**
   10.1 Concept of ageing theories:
      10.1.1 Intracellular changes: free radicals
      10.1.2 Extra cellular changes
   10.2 Cell death:
      10.2.1 Apoptosis: definition and significance
      10.2.2 Necrosis: definition and examples

11 **Cancer cell:**
   11.1 Characteristics
   11.2 Theories/hypothesis regarding causes of cancer
      11.2.1 Extrinsic causes: physical, chemical and biological agents (viruses).
      11.2.2 Intrinsic causes: somatic mutations, oncogenes and ageing related phenomenon
Reference Books

1. Cell and molecular biology, 2010, 8th Edn., De Robertis EDP and De Robertis EMF Jr., Lippincott Williams & Wilkins, Philadelphia
5. Cell and Molecular biology, 2013, 7th Edn., Gerald Karp, John Wiley and Sons, USA.
1 Introduction to biological techniques

1.1 Solution/strengths of chemicals: percentage, normality, molarity, molality, osmolarity, osmolality, ppm, ppb

1.2 Separation techniques: principle and applications, techniques related to isolation, purification and characterization of bio molecules

1.2.1 Chromatography (paper, ion-exchange), gel filtration
1.2.2 Electrophoresis-(agarose, polyacrylamide)
1.2.3 Ultracentrifugation
1.2.4 Colorimetry and spectroscopy

2 Haematological Techniques:

2.1 Blood cell count –Total count of RBCs, WBCs and Differential count of WBCs and their significance. Examination of bone marrow. Hb%, bleeding time, clotting time and their significance

2.2 Microscopy: simple, compound, phase contrast, electron - their principle & working
2.3 Micrometry
2.4 Camera Lucida

3 Micro technique:

3.1 Procurement of tissues and precautions to be taken to avoid tissue damage during procurement
3.2 Fixatives: Classification of fixatives and importance of fixation of tissues
3.3 Methods of fixation
3.4 Dehydration, clearing, impregnation and block making:

3.4.1. Clearing and alcoholising agents
3.4.2. Clearing and dealcoholisation
3.4.3. Impregnation and Embedding: Types of embedding media, methods of embedding and block making. Comments on hardening of paraffin

4 Microtomes and Knives:

4.1 Types of microtomes
4.2 Types of microtome knives
4.3 Section cutting: Microtomy- steps and precautions, common faults in section cutting- reasons & remedies. Mounting and spreading of ribbons

5 Stains and Staining

5.1 Classification of stains
5.2 Methods and types of staining
5.3 General procedure for staining of sections
5.4 Vital Stains
5.5 Mounting and labeling of sections: Classification of mounting media, refractive indices of mounting media

6 Histochemical staining:

6.1 Demonstration of Carbohydrates (PAS technique)
6.2 Demonstration of Nucleic acid (Feulgen Reaction)
References

10. Staining methods (Histological and Histochemical), 1960, Mc Manus J. F. A. And Mowry R.W., Paul B. Hoeber, Inc.; Harper & Brothers, NY
ZY- 342 (Paper II)
Mammalian Physiology & Endocrinology

Total lectures: 48

1 Introduction: Definition and scope

2 Nutrition:
   2.1 Concept of nutrition and energy requirements
   2.2 Physiology of digestion: digestive enzymes and their actions- salivary, gastric and intestinal digestion. Role of liver and pancreas in digestion

3 Circulation :
   3.1 Cardiac Cycle- systole, diastole and pacemakers
   3.2 Cardiac output and blood pressure
   3.3 Definitions and significance of electrocardiogram, colour doppler, angioplasty, angiography, angina pectoris, and coronary bypass

4 Respiration:
   4.1 Definition and types- Pulmonary and tissue respiration
   4.2 Mechanism of transport of gases
      (a) Transport of Oxygen- Oxyhaemoglobin formation
      (b) Transport of Carbon-dioxide
      (c) Respiratory Quotient and BMR

5 Excretion:
   5.1 Physiology of Urine formation- ultrafiltration, reabsorption, tubular secretion
   5.2 Counter-Current Multiplier theory for urine concentration
   5.3 Role of ADH, and Renin angiotensin system
   5.4 Definitions and clinical significance of- renal failure, renal calculi, dialysis

6 Muscles:
   6.1 Ultrastructure of striated muscle
   6.2 Sliding filament theory of muscle contraction – physical and chemical changes
   6.3 Response of muscles to stimulation- simple muscle twitch, muscle fatigue and rigor mortis

7 Nervous Excitation:
   7.1 Origin and conduction of nerve impulse, saltatory conduction
7.2 Synapse- ultrastructure and transmission of nerve impulse
7.3 Definitions/concepts: impulse, stimulation, conduction, response, EEG, epilepsy

8 Reproduction:
8.1 Reproductive cycles with hormonal control- estrous and menstrual
8.2 Hormonal control of pregnancy
8.3 Hormonal control of parturition and lactation
8.4 Hormonal control of male reproduction

9 Endocrinology:
9.1 Introduction
9.2 Mechanism of hormone action
9.3 Endocrine disorders: gigantism, acromegaly, dwarfism, diabetes insipidus, goiter, cretinism, myxodema, rickets, Addisson Disease, Cushing’s syndrome

Reference Books
3. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical applied agency, Kolkata
1. Linkage, crossing over and molecular basis of recombination

2. Gene Mutation
   2.1 Definition
   2.2 Types of mutations: spontaneous, induced, somatic, gametic, forward, reverse. Types of point mutation- deletion, insertion, substitution, transversion, transition
   2.3 Mutagenic agents.
      a) UV radiation and ionising radiation
      b) Base analogs, alkylating and intercalating agents

3. Population Genetics
   3.1 Basic Concepts in population genetics: Mendelian population, gene pool, gene frequency, chance mating (Panmictic mating)
   3.2 Hardy Weinberg law and its equilibrium

4. Molecular Biology
   4.1 DNA as genetic material- evidences (Griffith’s, Avery et al and Hershey and Chase experiment), RNA as genetic material-TMV
   4.2 Chromatin-Heterochromatin, Euchromatin, histones, nucleosome arrangement, packaging of DNA

5. Central Dogma of Molecular Biology
   5.1 DNA Replication-Semiconservative (Messelson and Stahl experiment) Mechanism in prokaryotes and eukaryotes
   5.2 Transcription- Transcriptional unit, RNA polymerase, transcription in prokaryotes and eukaryotes, post transcriptional modification (splicing- mRNA, modifications at 3’ and 5’ end)
   5.3 Translation- Genetic code, properties of genetic code, ribosome structure [prokaryotes and eukaryotes], protein synthesis–initiation, elongation, termination and concept of post translational modification (glycosylation)

6. Concept of operon - regulation of gene action, Lac operon, Trp operon

7. Recombinant DNA Technology-
   Introduction, restriction enzymes, cloning vector, PCR (polymerase chain reaction), DNA finger printing
Reference Books

5. Principles of Genetics, 2006, 8th Edn., Gardner E. J., Simmons M. J. and Snustad D. P., Wiley India Pvt Ltd
7. Genetics, 1985, 3rd revised Edn., Strickberger M. W., Macmillan USA
12. Cell and molecular biology, 2010, 8th Edn., De Robertis EDP and De Robertis EMF Jr., Lippincott Williams & Wilkins, Philadelphia
1 Introduction.

1.1 Origin of life
1.2 Origin of eukaryotic cell (Origin of mitochondria, plastids & symbionts)

2 Evidences in favour of organic evolution:

Evidences from: anatomy, embryology, geographical distribution, palaeontology, physiology, biochemistry, genetics and molecular biology

3 Theories of organic evolution

3.1 Lamarckism
3.2 Darwinism and Neo Darwinism
3.3 Mutation Theory
3.4 Modern Synthetic theory

4 Isolation:

4.1 Isolating mechanism
4.2 Classification of isolating mechanism: Pre-zygotic and post-zygotic

5 Speciation:

5.1 Types of speciation (Allopatric & Sympatric)
5.2 Mechanism of speciation
5.3 Patterns of speciation
5.4 Factors influencing speciation

6 Geological Time Scale

7 Animal Distribution:

7.1 Methods of distribution
7.2 Classification of animal distribution
7.3 Patterns of animal distribution
7.4 Factors affecting distribution

8 Antiquity of Man:

Evolution of anthropoids including man (Kenyapithecus to Homo sapiens)

9 Zoogeographical Realms: With reference to fauna
Reference Books

2. Introductions to Evolution, Paul Amos Moody, Kalyani Publishers, New Delhi.
1 **Introduction:**

1.1 Definition and scope

1.2 Theories of preformation, pangenesis, epigenesis, axial gradient and germ plasm

2 **Concepts in Developmental Biology:**

   Growth, differentiation, dedifferentiation, cell determination, cell communication, morphogenesis, induction and regeneration

3 **Gametogenesis:**

   3.1 General aspects and origin of germ cells

   3.2 Sperm: general structure, mention variations with reference to Insect, Amphioxus, Frog, Bird and Human

   3.3 Ultra structure of typical sperm. (entire, T.S. through head, middle piece and tail)

   3.4 Spermatogenesis: phases & spermiogenesis (nuclear and cytoplasmic changes)

   3.5 Oogenesis phases: growth phase- pre-vitellogenesis, vitellogenesis and post-vitellogenesis

   3.6 Oocyte maturation: role of MPF (maturation promotion factor)

   3.7 Ovum: general structure

   3.8 Egg membranes: primary, secondary and tertiary

   3.9 Types of eggs

4 **Fertilization:**

   4.1 Concept and types

   4.2 Attraction of gametes: sperm activation, chemotaxis (fertilizin and antifertilizin as enzymes and gamones as hormones)

   4.3 Sperm penetration: acrosome reaction, capacitation & decapacitation

   4.4 Activation of ovum: fertilization cone, polyspermy prevention: fast block (fertilization potential) & slow block (cortical reaction) & perivitelline space fertilization membrane

   4.5 Amphimixis

   4.6 Significance of fertilization
5 Cleavage

5.1 Mechanism
5.2 Planes and symmetry
5.3 Patterns / Types
5.4 Significance

6 Blastula: Definition and types

7 Gastrulation:

7.1 Concept
7.2 Basic cell movements in gastrulation: epiboly, emboly, convergence, invagination, ingress &involution (with reference to frog)
7.3 Organizer: primary, secondary, tertiary
7.4 Organogenesis: cell differentiation, tissue differentiation & organ formation up to rudimentary stage

8 Chick Embryology:

8.1 Structure of Hen’s egg
8.2 Fertilization and cleavage
8.3 Gastrulation:
   8.3.1 Formation of primitive endoderm
   8.3.2 Primitive streak development
   8.3.3 Head process and regression of Primitive streak
8.4 Development of nervous system up to 48 hours
8.5 Development of heart and blood vessels up to 48 hours
8.6 Development of digestive system up to 48 hours

9 Extra embryonic membranes

Reference Books
1 **Introduction and scope of public health**

2 **Health:**
   - 2.1 Definition, factors affecting health (inborn, environmental)
   - 2.2 Personal and community health.
   - 2.3 Effects of alcohol, tobacco and drugs
   - 2.4 WHO and its programmes

3 **Food:**
   - 3.1 Sources: Plants and Animals
   - 3.2 Necessity: deficiency diseases
   - 3.3 Beverages and condiments
   - 3.4 Food preservation methods

4 **Air and ventilation:**
   - 4.1 Composition of air
   - 4.2 Purification of air
   - 4.3 Ventilation system: natural and artificial

5 **Water and water supplies:**
   - 5.1 Sources and properties of water, quality of water for human consumption
   - 5.2 Process of purification of water- small scale and large scale
   - 5.3 Slow sand or biological filtration of water and rapid sand or mechanical filtration of water

6 **Soil:**
   - Composition, properties and diseases spread by soil

7 **Sanitation:**
   - 7.1 Definition and concept
   - 7.2 Disposal of human and animal waste, refuse, sewage

8 **Diseases:**
   - 8.1 Communicable diseases: causative organisms, signs and symptoms, modes of transmission, prevention and control measures of: influenza, chicken pox, measles, tuberculosis, leprosy, swine flu and encephalitis
8.2 Non Communicable diseases: rheumatic heart disease, coronary heart disease and diabetes

9 Demographic Biostatistics:
  9.1 Introduction
  9.2 Purpose of data sampling
  9.3 Methods of sampling

10 Epidemiology
  10.1 Introduction
  10.2 Epidemiologic methods
  10.3 Causes of epidemiology

11 Social and Industrial hygiene:
  11.1 Accident, emergencies in home and industries
  11.2 Occupational disease (details of diseases not expected)
  11.3 Provisions for disabled and mental hygiene
  11.4 Bio-safety for disabled and mental hygiene

12 Radiation risk

Reference Books
2. Preventive and social medicine in India, 2013, 4th Edn., B. K. Mahajan, M. C. Gupta, Jaypee Brothers Medical Publishers, New Delhi, India
3. Medical Zoology and Medical Technology. R.C. Sobti, Shobanlal and Co., Jalandhar
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<th>Chapter</th>
<th>Lectures</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Fundamentals of Agricultural, Forest, Medical and Veterinary Entomology</strong></td>
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<td>2</td>
<td><strong>Introduction to medical entomology</strong></td>
<td>06</td>
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<td></td>
<td>2.1 Morphology and anatomy of insects</td>
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<td><strong>Veterinary entomology- Insects as disease spreading agents in general</strong></td>
<td>06</td>
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<td><strong>Insects as social groups-</strong></td>
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<td>4.1 Definition, intraspecific and interspecific relationships among insects</td>
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<td>4.2 Social organization in wasps and termites</td>
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<td>4.3 Significance of social organizations</td>
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<td><strong>House hold insects in relation to human-</strong></td>
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<td>5.1 Cockroach</td>
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<td>5.2 House cricket</td>
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<td>5.3 Silver fish</td>
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<td>5.4 Carpet beetles</td>
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<td>5.5 Furniture beetles</td>
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<td>5.6 Ants</td>
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<td>6</td>
<td><strong>Study of following insects as causing agents of human diseases- their classification up to family, appearance, habit, brief life history, distribution, diseases caused and control measures-</strong></td>
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<tr>
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<td>6.1 Mosquito</td>
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<td>6.2 Flea</td>
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<td>6.3 House fly</td>
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<td>6.4 Bed bug</td>
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<td>6.5 Louse</td>
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<td>6.6 Tick</td>
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<td>6.7 Mite</td>
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<td>6.8 Blister beetle</td>
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Reference Books


4. Medical and Veterinary Entomology, 1995, 2nd Edn., Kettle D. S., CABI, UK


ZY-347 (Practical I)

ZY -331 Paper I Animal Systematics and Diversity V

Practicals:
1. Study of external characters and digestive system of *Pila*
2. A. Study of Nervous system of *Pila*  
   B. Temporary mounting of radula, osphradium and statocyst of *Pila*
3. Study of external characters and digestive system of *Calotes*
4. Study of arterial and venous system of *Calotes*
5. Study of nervous system of *Calotes*
6. A. study of male and female urinogenital systems of *Calotes*  
   B. Temporary mounting of scales, pecten and hyoid apparatus of *Calotes*
7. Study of Spicules in sponges
8. Study of *Balanoglossus*-external characters, T. S. through proboscis, collar and trunk
9. Comparative study of  
   A. Scales in fishes: Placoid, Cycloid, and Ctenoid  
   B. Heart: *Scoliodon*, Frog, *Calotes*, Pigeon and Rat  
   C. Brain: *Scoliodon*, Frog, *Calotes*, Pigeon and Rat
10. Study of accessory respiratory organs in fishes: *Anabas, Labeo, Clarias*
11. Compulsory study tour to visit costal locality / Bio-diversity area / Hilly area / ponds/ lakes / tanks / zoo / museum / science center- prepare tour report and submit at the time of examination

ZY-332 Mammalian Histology

Practicals:
1. Study of the different types of tissues with the help of permanent slides
2. Temporary mounting of tissues:  
   a) medullated nerve fiber  
   b) striated muscle fiber
3. Study of permanent histological slides of skin, tooth, tongue, stomach, duodenum, ileum, liver, pancreas and any one salivary gland
4. Study of permanent histological slides of trachea, lung, kidney, testis, ovary, thyroid and adrenal
5. Study of human blood smear to observe different cells
**ZY- 341 Biological Techniques**

**Practicals:**

1. a) Principle & use of camera lucida  
   b) Study of micrometer
2. Tissue collection & fixation. Block making
3. Sectioning, staining & mounting. Submission of any three permanent slides from three different organs
4. Total count of W.B.Cs.
5. Principle and applications of colorimeter and spectrophotometer.
6. Separation of amino acid mixture by ascending paper chromatography.

**ZY-342 Mammalian Physiology & Endocrinology**

**Practicals:**

1. a) Estimation of haemoglobin  
   b) Preparation of haemin crystals
2. To study the effects of various osmolarities on erythrocytes
3. To estimate the blood glucose level
4. Estimation of bleeding and clotting time
5. Study of any five disorders caused by endocrine glands with the help of photographs

**Minimum 24 practicals be performed during the year**
ZY-348 (Practical Course II)

ZY-333 - Biological Chemistry

Practicals

1. Study of principle and working of pH meter and measuring pH of three samples  
2. To study the effect of pH, temperature and inhibition on salivary amylase  
3. Detection of carbohydrates (monosaccharides, disaccharides and polysaccharides) with the help of suitable tests  
4. Isolation of casein by adjusting isoelectric point  
5. Study of preparation of standard acid and alkali and its standardisation

ZY-334- Environmental Biology and Toxicology

Practicals:

1. Study of fresh water plankton (field collection, preservation and gross identification)  
2. A visit to water body to study physiochemical properties of water. (Temperature, pH, turbidity, hardness, acidity and alkalinity) using analysis kit  
3. Study of physiochemical properties of soil sample (using analysis kit)  
4. Estimation of dissolved oxygen in water by winkler’s method  
5. Estimation of dissolved CO₂ in water  
6. Hypothetical problem to determine LC₅₀ and LD₅₀

ZY-343- Genetics and Molecular Biology

1. Study of Hardy- Weinberg law with suitable recording of genetic traits  
2. Temporary preparation of polytene chromosome from suitable material  
3. Estimation of DNA by Diphenylamine method  
4. Detection of DNA and RNA by Methylgreen Pyronin  
5. Preparation of DNA paper model
ZY 344-Organic Evolution

Practicals:

1. Study of morphological similarities and differences between man and ape  D
2. Study of types of fossils with the help of specimens/ charts/ photos D
3. Study of animal adaptations in: Turtle, Draco, Exocoetus, Bat and Parrot D
4. Study of evidences of evolution- embryological, palaentological, connecting links, morphology and comparative anatomy D
6. To record Zoogeographical distribution of animals to respective zoogeographical realms on the world map (Lung fishes, marsupials, flightless birds, Camel, Elephant, Ostrich etc.) E
ZY- 349 (Practical Course III)
ZY-335: Parasitology

Practicals:

1. Study of Life cycle of *Plasmodium vivax* and *Entamoeba histolytica* (whole mounts of life stages) D
2. Study of Life Cycle – *Ascaris lumbricoides* and *Taenia solium* (whole mounts of life stages) D
3. Study of morphology and pathogenicity of Head louse, Tick, Mite and blister beetle D
4. Study of vectors—mosquito, rat flea, house fly and bed bug D
5. To study rectal parasites of cockroach E

ZY-336 a) General Pathology

Practicals:

1. Study of pathogenic agents and pathological conditions with the help of suitable microscopic slides D
   a) *Mycobacterium tuberculosis*
   b) *Mycobacterium leprae*
   c) *Vibrio cholerae*
   d) * Anthrax bacilli*
   e) *Pneumococci* sp.
   f) *Trypanosoma* sp.
2. Study of pathological conditions with the help of suitable microscopic slides D
   a) Normal and diseased cell (Lung)
   b) Fatty degeneration (Liver)
   c) Cloudy degeneration/Swelling (Kidney)
   d) Dying cell – necrosis (Liver)
   e) Lung lobar pneumonia
   f) Ovarian cyst
   g) Thyroid goitre
3. Study of following pathological slides or specimens D
   a) Carcinoma in situ eg. Human cervix
b) Malignant cell
c) Organized thrombus
d) Ovary fibroid tumour/carcinoma
e) Carcinoma of colon-cauliflower growth
f) Carcinoma of stomach
g) Liver cirrhosis
h) Breast fibrocystic disease

4. To detect the normal and abnormal constituents of urine

5. Study of Gastric juice analysis by Toffler’s reagent (alcoholic solution of dimethylaminoazobenzol methyl orange indicator).

6. Visit to medical college/hospital/pathological laboratory

OR

ZY-336: b) Paper VI- Cell biology

Practicals:

1. Study of detection of mitochondria by Janus Green B
2. Study of permanent slides of mitosis & meiosis
3. Study of temporary preparation of different mitotic stages from onion root tip cells
4. To study the effect of Colchicine on mitosis
5. Study of temporary preparation of different meiotic stages from grasshopper testis / Tradescantia/ Onion floral bud

ZY-345 General Embryology

Practicals:

1. Study of sperm smear (any one animal), types of eggs (insect, amphioxus, frog and hen)
2. To study the types of blastulae and gastrulae (amphioxus, frog and hen)
3. Study of whole mount slides of chick embryology – 24h, 33hr and 48 hr
4. To study the sections of chick embryo--24hr, 33hr and 48 hr
5. Ex-ovo culture of chick embryo
6. Temporary preparation of chick embryo
ZY-346 – a) Public Health and Hygiene

Practicals:

1. To detect adulterants in the food samples by appropriate tests ................................................. E
2. To study the food preservation methods .................................................................................. E
3. Study of housefly, cockroach, ants and rats with reference to public health and hygiene .......... D
4. A compulsory visit to water purification / sewage treatment / effluent treatment plant .......... D
5. Testing potability of water for human consumption by MPN method ....................................... E
6. Any suitable example of measurement of dispersion ................................................................. E
   (Mean deviation or Standard deviation)

OR

ZY-346 -b) Medical Entomology

Practicals:

1. Study of interrelationships of insects and man (Any three) ..................................................... D
2. Study of household insects in relation to human health ............................................................ D
3. Study of social insects - honey bee and termites ....................................................................... D
4. Temporary preparation of mouth parts of harmful insects—mosquito, bed bug and house fly ... E
5. To study control methods of harmful insects with suitable examples (biological control measures, repellants, fumigation, dusting, netting) ................................................. D