FACULTY OF SCIENCE

SYLLABI

B.Sc.(Honours School) Zoology

1ST TO 6TH SEMESTER

EXAMINATIONS 2014 - 2015

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B.Sc. (HONS.SCHOOL) FIRST SEMESTER
OUTLINES OF TESTS

<table>
<thead>
<tr>
<th>Paper-I</th>
<th>English</th>
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<td>Botany</td>
<td>.. Subsidiary II: 100</td>
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<th>Paper-V</th>
<th>Zoology- II (Biodiversity : Chordates-I)</th>
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IMPORTANT NOTE:

The Environment & Road Safety Education is a compulsory qualifying paper, which the students have to study in the B.Sc. 1st year(2nd Semester). If the student/s failed to qualify the paper during the 2nd Semester, he/she/they be allowed to appear/qualify the same in the 4th or 6th Semester/s.
UNIT 1 (ENVIRONMENT)

Note: The syllabus has 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topic from 2 to 11 and one each for the topics 1 and 12 to 15.

1. Environment Concept:
   Introduction, concept of biosphere—lithosphere, hydrosphere, atmosphere; Natural resources—their need and types; principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.

2. Atmosphere:
   Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere:
   Types of aquatic systems. Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks and possible control measures.

4. Lithosphere:
   Earth crust, Soil—a life support system, its texture, types, components, pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests:
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, Chipko Andolan.

6. Conservation of Environment:
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems—soil, water, air, wildlife, forests.

7. Management of Solid Waste:
   Merits and demerits of different ways of solid waste management—open, dumping, landfill, incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic farming.

8. Indoor Environment:
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and polythene; hazardous chemicals, solvents and cosmetics.

9. Global Environmental Issues:
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity; Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment:
    Indian laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about Laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. Biodiversity:
    What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. Noise and Microbial Pollution:
    Pollution due to noise and microbes and their effects.

13. Human Population and Environment:

14. Social Issues:
    Environmental Ethics: Issues and possible solutions, problems related to lifestyle, sustainable
development; Consumerisms and waste generation.

15. **Local Environmental Issues:**
Environmental problems in rural and urban areas, Problem of Congress grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals:**
Depending on the available facility in the college, a visit to Vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

**Examination Pattern:**
A qualifying paper of 50 marks comprising of fifty multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong answer or unattempted question), and of 1 hour duration.

The students have to obtain 33% marks to qualify the paper. The marks are not added/included in the final mark sheet.

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
3. Traffic Engineering – Concept & Significance.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.

**Note:** Examination Pattern:
- The Environment and Road Safety paper is 70 marks.
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted questions).
- The paper shall have two units: Unit I (Environment) and Unit II (Road Safety).
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit II is to be covered in 10 hours.
- All the questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination: 90 minutes.
- The paper setter is requested to set the questions strictly according to the syllabus.

**Suggested Readings**

2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

**Websites:**
(a) www.chandigarhpolice.nic.in
(b) www.punjabpolice.gov.in
(c) www.harvnapolice.gov.in
(d) www.hppolice.nic.in
Syllabus and Courses of Reading for B.Sc. (Hons. School) (courses where English is taught as a subsidiary subject)

FIRST SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:
I. The Judgement Seat of Vikramaditya, Sister Nivedita
II. Engine Trouble, R. K. Narayan
III. The Conjurer’s Revenge, Stephen Leacock

Drama:
I. The Rising of the Moon, Lady Gregory
II. Waterloo, Arthur Conan Doyle

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

Communication: It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

Writing Skills: This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.,

Modern Forms of Communication: Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.,

Practical work:
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be
done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100).

**Testing Scheme:**
The examination paper shall be divided into two sections, corresponding to two units already proposed in the syllabus. The distribution of questions and marks in Section I shall be as follows:

**Section I** (It is text-based and corresponds to unit I in the syllabus)
Q1. It shall consist of **five** short questions (not exceeding 100-120 words) out of which a student will be expected to attempt any three. This question shall be based upon the prescribed text *Varieties of Expression* and cover a wide range of issues, topics and problems. It shall consist of **12 marks**.
Q2. It shall consist of **two** long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text *Varieties of Expression*. This shall carry **10 marks**.

Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.
Q3. It shall consist of an **Unseen Passage for Comprehension** (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of **12 marks**.

Q.4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column. This shall carry **6 marks**.

**Section II (Based upon Unit II)**
Q.5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry 8 marks.
Q.5 (b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It'll carry **4 marks**.

Q.6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of **8 marks**
Q.7 There will test a student’s ability to write a Précis, A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry **10 marks**.
Q.8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:

(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It'll carry **6 marks**.
(b) Definitions/format of modern forms of communication to be tested. This shall again carry **4 marks**.

**Suggested Reading:**
SECOND SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e. prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:
I   J. C. Bose, Aldous Huxley
II  The Position of Women in Ancient India, Padmini Sen Gupta

Drama:
I   The Proposal, Anton Chekhov
II  Riders to the Sea, J. M. Synge
III Lithuania, Rupert Brooke

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

Communication: It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

Writing Skills: This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.,

Modern Forms of Communication: Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.

Practical work:-
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

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Q2. It shall consist of two long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text Varieties of Expression. This shall carry 10 marks.

Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.
Q3. It shall consist of an Unseen Passage for Comprehension (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of 12 marks.
Q4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column, This shall carry 6 marks.

Section II (Based upon Unit II)
Q5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry 8 marks.
Q5 (b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It’ll carry 4 marks.
Q6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of 8 marks
Q7 There will test a student’s ability to write a Précis, A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.
Q8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:
(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.
(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:
SYLLABUS
ZOLOGY MAJOR
Zoology – I (Biodiversity : Invertebrates-I)  (BZO 1001)

Total Marks : 100

Theory : 75
Internal Ass. : 15
Annual Exam. : 60

Practical : 25
Internal Ass. : 05
Annual Exam : 20

Objectives
To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from acellular to multicellular animals. Studies on this group of animals bring to light knowledge of basic functions of life viz., nutrition, respiration, excretion, reproduction etc. and how the organisms of various phyla structurally and functionally adapt themselves for surviving in different ecological conditions.

Classification and general characters of the following phyla up to orders with a detailed study of the animals mentioned against each phylum in Units given below:

UNIT-I
Protozoa : Amoeba, Euglena, Paramecium, Plasmodium

UNIT-II
Porifera : Sycon
Coelenterata : Obelia, Aurelia, Sea anemone

UNIT-III
Platyhelminthes : Planaria, Fasciola, Taenia

UNIT-IV
Nematoda : Ascaris, Enterobius, Hookworm

Note : Examiner will set a total of nine questions comprising two questions from each Unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.

Books Recommended
Zoology-II (Biodiversity: Chordates-I) (BZO 1002)

Objectives

To acquaint the students about the structure and function of protochordates and chordates and to make the student understand the basic characters, advancements and adaptations of different types of vertebrates.

Detailed study (morphology & anatomy), systematic position, distinctive characters, distribution, ecology, economic importance, if any, of the following animals:

UNIT-I
Urochordata : Heldmania including development and affinities, alternation of generation in Urochordata.

UNIT-II
Cephalochordata : Branchiostoma including its development and affinities.
Cyclostomata : Petromyzon including its migration.

UNIT-III
Pisces : Labeo
Amphibia : Rana

UNIT-IV
Reptilia : Uromastix

Note: Examiner will set a total of nine questions comprising two questions from each Unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.

Book Recommended
Classification up to orders and study of the specimens mentioned against each phylum with ecological note.

1. **Protozoa**
   - (a) Culture of *Amoeba, Euglena, Paramecium* and *Vorticella*.
   - (b) Prepared slides of *Balantidium, Nyctotherus, Opalina, Radiolarian* and Foraminiferan.

2. **Porifera**
   - (a) Specimens: *Sycon, Grantia, Spongilla, Euplectella, Hyalonema, Chalina, Euspongia*.
   - (c) Temporary mounts: Gemmules and spicules of *Sycon*.

3. **Coelenterata**
   - (a) Specimens: *Porpita, Velella, Physalia, Aurelia, Metridium, Alcyonium, Tubipora, Zooanthus, Madrepora, Favia, Fungia, Gorgonia* and *Pennatula*.
   - (b) Prepared slides: *Hydra* (W.M.) with bud, T.S. through the regions of testis and ovary, *Obelia* (colony, medusa and polyp), *Sertularia, Tubipora, Plumularia, Pennaria, Bougainvillea*.
   - (c) Permanent preparations: W.M. of *Hydra, Obelia, Sertularia, Tubularia, Plumularia, Statocyst of Aurelia*.

4. **Platyhelminthes**
   - (a) Specimens: *Planaria, Fasciola, Taenia, Ascaris* (male and female).
   - (c) Permanent preparations: *Planaria, Fasciola*, (W.M. of Larvae: miracidium, sporocyst, redia, cercaria), *Taenia* (scolex, mature and gravid proglottids).

**Note**: Candidate will be required to submit duly signed note-books of practical record.

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**Practical – II based on Theory Paper BZO 1002 (BZO 1052)**

Classification up to orders and study of the specimens mentioned against each phylum with ecological note.

1. **Dissections of the following Animals to study**:
   - (a) *Herdmania* : General Anatomy.
   - (b) *Labeo* : Digestive and reproductive systems

2. **Skeleton** : To study the skeleton of *Labeo, Rana, Varanus*. 

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4. Prepared Slides : T.S. Branchiostoma through different regions, cycloid and ctenoid scales of fishes.

5. Specimens : General survey and classification up to orders, (excep Pisces and Aves where it is required only upto sub-classes), habitat, habits, external characters and economic importance (if any) of the following animals.

Protochordata - Herdmania, Molgula, Ciona, Ascidia, Botryllus, Pyrosoma, Salpa, Doliolum, Oikopleura and Branchiostoma.


Dipneusti (Dipnoi) – Any of the lungfishes.


Reptilia- Tortoise, Turtle, Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Erys, Ptyas, Bungarus, Naja, Hydrus, Vipera, Crocodilus, Gavialis and Alligator.

Note : The candidates are required to submit duly signed note books of practical record and the prepared slides.

ZOOGOGY SUBSIDIARY
Zoology Paper – I (Invertebrate-I) (BZO 1031)

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<td>Practical</td>
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<tr>
<td>Annual Exam</td>
<td>20</td>
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</table>
Objectives

To enable the students to understand the basic biology of Invertebrates. To understand that the biological science is fundamental to creative thought and the diversity of invertebrate species provides the excellent examples for some of these central principles.

Classification and general characters of following Phyla up to orders with a detailed study of the animals mentioned against each phylum in the Units given below:

**UNIT – I**
Protozoa : *Amoeba, Euglena, Paramecium* and *Plasmodium*.

**UNIT – II**
Porifera : *Sycon*
Coelenterata : *Obelia*

**UNIT – III**
Platyhelminthes : *Planaria, Fasciola hepatica, Taenia solium, Parasitic adaptations of Platyhelminthes.*

**UNIT – IV**
Nematoda : *Ascaris, Hook worm, Enterobious*

Note: Examiner will set a total of **nine** questions comprising **two** questions from each Unit, and **one compulsory question** of short answer type covering the whole syllabus. It will consist of **eight short answer questions** of 1½ marks each. Students will attempt one question from each Unit and the **compulsory questions**. All questions may carry equal marks.

**Books Recommended**

**Zoology Subsidiary**

**Practical – I based on Theory Paper BZO 1031 (BZO 1071)**

<table>
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<td>Internal Ass.</td>
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<td>Annual Exam.:</td>
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Classification up to orders and important characters alongwith ecological note of the specimens mentioned against each phylum.

1. **Protozoa**
   (a) Culture of *Amoeba, Euglena, Paramecium* and *Vorticella*.
   (b) Prepared slides: *Balantidium, Nyctotherus, Opalina*, Radiolarian and Foraminiferan oozes.

2. **Porifera**
   (a) Specimens: *Sycon, Grantia, Spongilla*.
   (b) Prepared slides: Spicules, Gemmules, *Sycon* (T.S. and L.S.)
   (c) Permanant mount: Gemmules and Spicules.
3. **Coelenterata**  
(a) Specimens: *Porpita, Velella, Physalia, Aurelia, Metridium, Alycyonium, Tubipora, Zooanthus, Madrepora, Favia, Fungia.*  
(b) Prepared slides: *Hydra* (W.M. with bud, T.S. through the regions of testis and ovary), *Obelia* (colony and medusa), *Sertularia, Tubularia, Plumularia.*  
(c) Permanent mount: W.M. of *Hydra, Obelia, Sertularia, Tubularia, Plumularia.*  

4. **Platyhelminthes** (a) and **Nematoda** (b) Specimens: *Planaria, Fasciola, Taenia, Ascaris* (male & female).  

**Note:** Candidates will be required to submit duly signed note-books of practical record and prepared slides.
### OUTLINES OF TESTS AND SYLLABI IN THE SUBJECT OF ZOOLOGY FOR B.Sc. (HONOURS SCHOOL) (SEMESTER SYSTEM)

#### B.Sc. (HONS.SCHOOL) SECOND SEMESTER

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<th>Paper-I</th>
<th>English</th>
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<td><strong>Theory</strong> : 75</td>
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| Paper-V | Zoology-IV (Biodiversity : Chordates-II) | Major |
|         |         | **Total Marks** : 100 |
|         |         | **Theory** : 75 |
|         |         | Internal Ass. : 15 |
|         |         | Annual Exam : 60 |
|         |         | **Practical** : 25 |
|         |         | Internal Ass. : 05 |
|         |         | Annual Exam : 20 |
SYLLABUS
ZOOLOGY MAJOR
Zoology – III (Biodiversity: Invertebrates-II)      (BZO 1003)

Total Marks : 100
Theory : 75
Internal Ass. : 15
Annual Exam. : 60
Practical : 25
Internal Ass. : 05
Annual Exam : 20

Objectives
To enable the student to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from unicellular to multicellulars. Studies on this group of animals bring to light variety of modes of performing basic functions of life viz., nutrition, respiration, excretion, reproduction etc. and how the organisms of various phyla structurally and functionally adapt themselves for surviving in different ecological conditions.

Classification and general characters of the following phyla up to orders with a detailed study of the animals mentioned against each phylum in Units given below. :

UNIT-I
Annelida : Nereis, Earthworm

UNIT-II
Arthropoda : Palaemon, Cockroach

UNIT-III
Mollusca : Pila, Anodonta

UNIT-IV
Echinodermata : Asterias, Sea urchin, Sea cucumber
Hemichordata : Balanoglossus (external characters only) and its systematic position.

Note : Examiner will set a total of nine questions comprising two questions from each Unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.

Books Recommended
Zoology-IV (Biodiversity : Chordates-II and Evolution) (BZO 1004)

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**Total Marks** : 100
**Theory** : 75
**Internal Ass.** : 15
**Annual Exam.** : 60
**Practical** : 25
**Internal Ass.** : 05
**Annual Exam** : 20

**Objectives**
To acquaint the students about the structure and function of chordates and to make the student understand the basic characters, advancements and adaptations of different types of vertebrates.

Detailed study (morphology & anatomy), systematic position, distinctive characters, distribution, ecology, economic importance, if any, of the following animals:

UNIT-I
Aves : Columba

UNIT-II
Mammalia : Oryctolagus

UNIT-III
Origin of life : Origin of bio molecules (DNA, RNA) and its scientific evidence, Origin of prokaryote and eukaryote cells, Origin of unicellularity and multicellularity.
Evidences from Zoogeography, taxonomy, comparative morphology and anatomy, Palaeontology, Comparative physiology, embryology, genetics, molecular biology and biochemistry.

UNIT-IV
Theories : Lamarckism and Neo-Lamarckism; Darwinism and Neo-Darwinism (Synthetic theory) : Weismann’s theory; Mutation theory; mutation, variations and selection; modern concept of interpretation of evolution and future of evolutionary process.

Note : Examiner will set a total of nine questions comprising two questions from each Unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.

**Book Recommended**
Classification up to orders and study of the specimens mentioned against each phylum with ecological note.

1. Annelida
   (a) Dissections: Earthworm (Eutyphoeus/Pheretima), Nereis. (Nervous, digestive, excretory and reproductive systems).
   (b) Specimens: Pheretima, Eutyphoeus, Lumbricus, Nereis, Heteronereis, Polynoe, Aphrodite, Amphitrite, Chaetopterus, Arenicola, Hirudinaria, Pontobdella.
   (c) Prepared slides: Earthworm (T.S. typhlosolar region, setae, pharyngeal nephridia, septal nephridium and integumentary nephridium).

   Nereis (parapodium of Nereis and Heteronereis),
   Permanant preparations: Setae and nephridia of earthworm, parapodium of Nereis.

2. Arthropoda
   (a) Dissections: Cockroach (digestive, nervous and reproductive systems), Prawn (appendages, digestive and nervous systems).
   (b) Specimens: Peripatus, Lepisma, cockroach, grasshopper, praying mantis, earwig, dragonfly, termite (queen and other castes), ant, butterfly, moth, beetle, wasp, honeybee, crab, prawn, Lepas, Balanus, Apus, Limulus, scorpion, spider, millipede and centipede.
   (c) Permanant mounts: Trachea of insect, mouthparts of cockroach, Cypris, Cyclops, Daphnia, Gill and statocyst of prawn.

   Prepared slides: Body louse, bed-bug, ratflea, Cypris, Cyclops, Daphnia, trachea of insects, genitalia of cockroach, gill and statocyst of prawn.

3. Mollusca
   (a) Dissection: Anodonta (digestive and nervous system), Pila (pallial complex, digestive and nervous systems).
   (b) Specimens: Anodonta, Mytilus, Pholas, Pecten, Haliotis, Aplysia, Doris, Limax, Pila, Sepia, Octopus, Nautilus, Chiton and Anodonta.
   (c) Prepared slides: Glochidium larva, radula of Pila and gill lamina of Anodonta.
   (d) Permanant mount: Glochidium larva and radula of Pila.

4. Echinodermata
   (a) Specimens: Asterias, Echinus, Cucumaria, Antedon, Ophiothrix.
   (b) Prepared slide: T.S. of Star-fish.

5. Hemichordata
   (a) Specimens: Balanoglossus.
   (b) Prepared slide: T.S. Balanoglossus, Tornaria larva.

Note: Candidate will be required to submit duly signed note-books of practical record.
Practical – II based on Theory Paper  BZO 1004  (BZO 1054)

Marks : 25
Internal Ass. : 05
Annual Exam.: 20

1. Dissections of the following Animals.
   (a) Fowl : Digestive, arterial, venous and urinogenital systems.
   (b) Rat : Digestive, arterial, venous and reproductive systems.

2. Skeleton : Gallus and Oryctolagus.


Note : The candidates are required to submit duly signed note books of practical record.

ZOLOGY SUBSIDIARY
Zoology Paper – II  (BZO 1032)

Total Marks : 100
Theory : 75
Internal Ass. : 15
Annual Exam. : 60
Practical : 25
Internal Ass. : 05
Annual Exam : 20

Objectives

To enable the students to understand the basic biology of Invertebrates. To understand that the biological science is fundamental to creative thought and the diversity of invertebrate species provides the excellent examples for some of these central principles.

Classification and general characters of following Phyla up to orders with a detailed study of the animals mentioned against each phylum in the Units given below :

UNIT-I
Annelida : Earthworm

UNIT-II
Arthropoda : Palaemon, Cockroach
UNIT – III

Mollusca : Anodonta, Pila

UNIT-IV

Echinodermata : Asterias
Hemichordata : Balanoglossus (external characters and its systematic position)

Note: Examiner will set a total of nine questions comprising two questions from each Unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.

Books Recommended

Zoology Subsidiary
Practical – I based on Theory Paper BZO 1032 (BZO 1072)

Total Marks : 25
Internal Ass. : 05
Annual Exam.: 20

Classification up to orders and important characters alongwith ecological note of the specimens mentioned against each phylum.

1. Annelida
   (a) Dissections: Earthworm (entire anatomy)
   (b) Specimens: Pheretima, Nereis, Heteronereis, Polynoe, Aphrodite, Amphiirite, Chaetopterus, Arenicola and Pontobdella.
   (c) Permanant mount: Setae of earthworm.

2. Arthropoda
   (a) Dissections: Cockroach (digestive, nervous and reproductive systems), Prawn (appendages, digestive, nervous and reproductive systems).
   (b) Specimens: Peripatus, Lepisma, Cockroach and Grasshopper praying mantis, Earwig, Dragonfly, Termite, (queen and other castes), ant, Butterfly Moth, Beetle, Wasp, Honeybee, Crab, Prawn, Lepas, Balanus, Apis, Limulus, Scorpion, Spider, Millepede and Centipede.
   (c) Permanant mount: Trachea of insect, mouth parts of cockroach, Cypris, Cyclops, Daphinia, gill and statocyst of prawn.
   (d) Prepared slides: Body louse, bed- bug, ratflea, Cypris, Cyclops, Daphinia, trachea of insects, genitalia of cockroach, gill and statocyst of prawn.

3. Mollusca
   (a) Dissection: Anodonta (digestive and nervous systems), Pila (pallial complex, digestive and nervous systems).
   (b) Specimens: Anodonta, Mytilus, Pholas, Pecten, Haliotis, Aplysia, Doris, Limax, Pila, Octopus, Nautilus shell, Chiton and Dentalium.
   (c) Prepared slides: Glochidium larva, radula of Pila, gill lamina of Anodonta.
   (d) Permanant mount: Glochidium larva and radula of Pila.
4. Echinodermata (a) Dissection: Asterias (digestive and water vascular systems).
   (b) Specimens: Asterias, Echinus, Cucumaria, Antedon, Ophiothrix.
   (c) Prepared slide: T.S. of Star-fish.

5. Hemichordata (a) Specimens: Balanoglossus.
   (b) Prepared slide: T.S. Balanoglossus.

Note: Candidates will be required to submit duly signed note-books of practical record.

1st Year B.Sc. (Hons. School)
Zoology Subsidiary (BZO 1033)

(For Basic Medical Sciences only)

Theory

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Objectives

To enable the students to identify, classify and study the general characters of invertebrates and vertebrates. To make the students understand the concept of speciation and origin of life. To enable the students to understand the structure of cell, its organelles and types of cell division.

UNIT-I
1. Classification and general characters of invertebrates and vertebrates up to class with important examples.

UNIT-II
2. Detailed study of Plasmodium, Fasciola, Ascaris, cockroach and rabbit.

UNIT-III
3. Study of cell and its organelles, mitosis and meiosis, and their importance.
4. Study of simple and compound tissues.

UNIT-IV
5. Mendel’s laws, chromosomal theory of inheritance.

Note: Examiner will set a total of nine questions comprising two questions from each Unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.
Books Recommended

Practical based on theory Paper BZO 1033 (BZO 1073)  
(For Basic Medical Sciences only)
Marks : 25  
Internal Ass. : 05  
Annual Exam. : 20

Classification up to orders of the following specimens with important characters:
Protists : Amoeba, Paramecium, Euglena, Volvox
Porifera : Sycon
Platyhelminthes : Fasciola, Tapeworm, Ascaris
Annelida : Nereis, Pheretima, Hirudinaria
Arthropoda : Cockroach, Prawn, Scorpion
Mollusca : Unio, Pila, Sepia
Echinodermata : Asterias, Echinus, Cucumaria
Hemichordata : Balanoglossus
Urochordata : Herdmania
Cephalochordata : Branchiostoma
Cyclostomata : Petromyzon
Chondrichthyes : Scoliodon
Osteichthyes : Labeo
Amphibia : Frog and Toad
Reptilia : Uromastix, Wall lizard, Python, Cobra, Krait and Viper
Aves : Columba
Mammalia : Oryctolagus
Dissections : Rabbit/Rat (digestive, circulatory, reproductive systems)
Skeleton : Rabbit
Permanent slides : Simple tissues, mouth parts of cockroach.

Note: Candidate will be required to submit the original duly signed note books containing a record of their laboratory work.
B.Sc. (Honours School) - Zoology
SECOND YEAR (THIRD SEMESTER) EXAMINATION

OUTLINES OF TESTS

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<td>Paper-II</td>
<td>Botany</td>
<td>100 marks</td>
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<td>Paper-III</td>
<td>Zoology V – Functional Anatomy of Non-Chordates-I</td>
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<td>Zoology VI- Functional Anatomy of Non-Chordates-II</td>
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<td>(Helminths)</td>
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<td>Paper-V</td>
<td>Zoology VII – Functional Anatomy of Non-Chordates-III</td>
<td>100 marks</td>
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<td>(Arthropoda-I)</td>
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Objectives:

- To acquaint the students with the variety of non-chordates from Protozoa, Porifera and Coelenterata to study their functional anatomy.
- To enable the students to understand the difference in their morphology and general anatomy and to classify and study their general characters.

Protozoa

Unit –I

- Protozoa: General organisation, comparative account of morphology (size, shape, skeleton, nucleus, locomotor organelles etc.), nutrition, locomotion, reproduction, excretion, behaviour, osmoregulation etc.

Unit-II

- Detailed classification of Protozoa (N.D. Levine, 1980).
- General account including morphology, life cycle, pathogenicity, diagnosis and prophylaxis of important parasitic protozoan’s of man representing each taxon for example: - Leishmania, Trypanosoma, Balantidium, Giardia, Entamoeba, Toxoplasma, Trichomonas.

Unit-III

Porifera

- General organisation, classification up to orders of Porifera mentioning their characteristic features with examples.
- Comparative account of canal system, skeletal system, reproduction and development of sponges.
Unit-IV

Coelenterata
- General organisation, classification up to orders of Coelenterates giving their characteristic features with examples.
- Corals and coral formation, polymorphism and affinities of the group.
- Life history and alternation of generation in coelenterata.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of $1\frac{1}{2}$ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

(Protozoa, Porifera, and Coelenterata)

Protozoa
- Prepare permanent stained preparations of protozoans from fresh water culture and intestine of cockroach.
- Prepare permanent, stained preparations of Volvox, Ceratium, Vorticella.
- Study of permanent slides from the museum of the Department.

Porifera
- General survey of sponges by the study of specimens and slides of important representatives from various poriferan classes.
- Permanent slides for the study of canal system, spicules and various developmental stages.
- Preparation of slides of spicules and developmental stages.

Coelenterata
- General survey of coelenterates by the study of specimens and permanent slides of important representatives.
- Preparation of permanent stained slides of various representatives.

Books recommended
Objectives

- To acquaint the students with the latest classification, general organization, comparative account of morphology and physiology of Platyhelminthes & Nematodes.
- To introduce the student to the important parasites causing diseases in animals and men.
- To make the students study a comparative account of variation in their morphology, lifecycles, pathogenicity etc.

Unit-I

Platyhelminthes

1. Turbellaria: General organisation, classification and ecology.
2. Trematoda: General organisation, classification and ecology.
3. Monogenea: General account, structure and function, development and ecology of important forms.
4. Digenea:
   i. General account, structure and functions, development and ecology of important forms representing the following families:
      - Dicrocoeliidae, Opisthorchiidae, Troglotrematidae, and Schistosomatidae.
   ii. Varied types of cercariae and other larval forms, variation in life cycles in Digenea.

Unit-II

   i. Cestodaria: General account with special reference to the morphology and functions, and life cycles of typical cestodians.
   ii. Eucestoda: General account and classification with special reference to the structure and functions, development and effect of the important forms representing Pseudophyllidea and Cyclophyllidea and also with special reference to the distribution, patterns of life cycles and larval forms met within the group.

Unit-III

Aschelminthes

- General characters and classification with special reference to morphology and functions and life cycle of a typical nematode and other important forms representing the following families: Trichuridae, Ancylostomatidae, Oxyuridae, Filaridae, Dracunculidae, Strongylidae, Trichinellidae.

Unit-IV

- Comparative account of the pharynx, excretory and reproductive systems in Nematoda.
- A brief account of plant parasitic nematodes.
Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1\(\frac{1}{2}\) marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

**Practical - Paper-IV : Zoology VI- Functional Anatomy of Non-Chordates-II (Helminths)**

**Trematoda**
- Collection, fixation, preservation and staining of trematodes from rumen of a ruminant, intestine of fish, fowl and goat/sheep.
- Preparation of permanent slides of different larval stages from snails.
- Preparation of permanent stained slides of trematodes of the preserved material
- Study of permanent slides (W.M. and T.S.) and specimens from the museum of the Department.

**Cestoda**
- Collection, fixation, preservation and staining of cestodes from intestine of fish, fowl and sheep or goat.
- Preparation of permanent stained slides of cestodes from the preserved material
- Study of permanent slides (W.M. and T.S.) and specimens from the museum of the Department.

**Nematoda**
- Collection, fixation, preservation and study of nematodes from intestine of cockroach, fish, fowl, and sheep or goat.
- Study of anatomy of *Ascaris*.
- Study of permanent slides (W.M. and T.S.) and specimens from the museum of the Department.
- Collection and study of plant parasitic and free-living nematodes.

**Books Recommended**
Objectives

- To enable the students to understand the dominance of Arthropods and their association with human welfare in a number of ways.
- To impart in depth knowledge about their different modes of living and structural modification acquired to suit varied living conditions.

Unit-I

- General characters and classifications up to orders with examples of class Crustacea.
- General characters and classifications up to orders with examples of class Arachnida.
- General account of classes Trilobita, Onychophora, Symphyla, Chilopoda and Diplopoda.

Unit-II

- Larvae of Crustacea.
- Comparative functional anatomy of digestive, respiratory, circulatory, nervous and reproductive systems of Crustacea.
- Endocrine glands and their function in moulting, pigmentation and reproduction in Crustacea.

Unit-III

- Structural organisation of class Insecta, criteria and history of classification.
- Salient features of various apterygote orders and important pterygote orders (Ephemeroptera, Odonata, Orthoptera, Hemiptera, Lepidoptera, Diptera, Hymenoptera, Coleoptera) with examples.

Unit-IV

- Development of head and the study of head capsule in insecta; general structure and the functional modifications in tentorium, antennae and mouthparts in insects.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1 1/2 marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.


1. General survey of Arthropoda other than insects by the study of specimens and slides of important representatives from various classes.
2. Study of different types of larvae of crustaceans with the help of slides and preserved material.
3. Study of insects from different orders.
4. Study of small insects forms by preparing permanent stained preparations.
5. Comparative study of the external functional morphology of insects by preparing permanent stained preparations of:
   (a) Head capsule
   (b) Head appendages
   (c) Tentorium

Books recommended

ZOOLOGY SUBSIDIARY
Zoology-III (Biodiversity: Chordates-I)

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**Theory**
- Internal Ass. : 15
- Annual Exam. : 60

**Practical**
- Internal Ass. : 05
- Annual Exam : 20

Objectives
To acquaint the students about the structure and function of protochordates and chordates and to make the student understand the basic characters, advancements and adaptations of different types of vertebrates.

Detailed study (morphology & anatomy), systematic position, distinctive characters, distribution, ecology, economic importance, if any, of the following animals:

**UNIT-I**
- Urochordata : *Herdmania* including retrogressive metamorphosis (excluding embryology) and its affinities.
- Cephalochordata : *Branchiostoma* (excluding embrology) and its affinities.

**UNIT-II**
- Cyclostomata : *Petromyzon* (external characters) and its migration.
- Pisces : *Labeo*
UNIT-III

Amphibia : Rana

UNIT-IV

Reptilia : Uromastix

Note: Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer questions of 1½ marks each. Students will attempt one question from each Unit and the compulsory questions. All questions may carry equal marks.

Book Recommended

Practical: Zoology-III (Biodiversity: Chordates-I)

Marks : 25
Internal Ass. : 05
Annual Exam.: 20

1. Dissections of the following Animals to study:
   (a) Herdmania : General Anatomy.
   (b) Labeo : Digestive, arterial and reproductive systems
2. Skeleton : To study the skeleton of Labeo, Rana and Varanus.
4. Prepared Slides : Tornaria larva, T.S. Branchiostoma through different regions, cycloid and ctenoid scales of fishes.
5. Specimens : General survey and classification up to orders, (except Pisces where it is required only upto sub-classes), habitat, habits, external characters and economic importance (if any) of the following animals.
   Protochordata - Herdmania, Molgula, Ciona, Ascidia, Botryllus, Pyrosoma, Salpa, Doliolum, Oikopleura and Branchiostoma.
   Cyclostomata – Myxine, Petromyzon and Ammocoetes larva.
Chondrichthyes – Zygaena, Pristis, Narcine, Trygon and Rhinobatus.
Actinopterygii – Polypterus, Acipenser, Lepidosiren, Mystus, Catla, Labeo r.ohita, Cirrhinus mrigala, Cyprinus carpio, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echeneis, Lophius, Solea and Anguilla.
Dipneusti (Dipnoi) – Any of the lungfishes.


Note: The candidates are required to submit duly signed note books of practical record and the prepared slides.
B.Sc. (Honours School) - Zoology  
SECOND YEAR (FOURTH SEMESTER) EXAMINATION  
OUTLINES OF TESTS

Total Marks: 500

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**Total Marks** : 100

**Theory** : 75
**Internal Ass.** : 15
**Annual Exam.** : 60

**Practical** : 25
**Internal Ass.** : 05
**Annual Exam** : 20

**Objectives**

- To enable the students to understand the dominance of Arthropods and their association with human welfare in a number of ways.
- To impart in depth knowledge to students about the different modes of living and structural modification acquired to suit varied living conditions.

**Unit-I**

- Preliminary knowledge of thoracic and abdominal segments of insects.
- General structure and functional modifications in the wings and legs in different insect groups.
- External male genitalia and external female genitalia in different insect group.

**Unit-II**

- Comparative account of the structure and functions of digestive system in insects with special reference to the functional modifications like filter chamber and peritrophic membrane and digestive glands.
- Comparative account of the nervous in insects.

**Unit-III**

- Comparative account of the male and female reproductive systems in insects.
- General structure and functions of excretory, respiratory and circulatory systems in insects.

**Unit-IV**

- Postembryonic development and types of metamorphosis in insects.
- Structural modifications in larvae and pupae and relationship of nymphs and naiads.
Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1 1/2 marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practical- Paper-VI Zoology VIII – Arthropoda –II
(Functional Anatomy of Non-Chordates-IV)

1. Comparative study of the external functional morphology of insects by preparing permanent stained preparations of:
   - Wings
   - Legs
   - Genitalia

2. Dissection of suitable insects for the study of internal functional anatomy:
   - Digestive System
   - Nervous system
   - Reproductive systems

3. Study of different types of insect larvae and pupae.

Books recommended

Paper-VII- Zoology IX- Functional Anatomy of Non-Chordates-V
(Annelida and Minor phyla)

Total Marks : 100

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<th>Component</th>
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Objectives
• To acquaint the students with the variety of Annelida and various minor phyla so as to
  make them aware of the diversity and evolutionary affinities.
• To enable the students to understand the difference in the morphology and general
  anatomy and to classify and study the general characters of these groups.

Unit-I
Annelida
• General organization and classification of Annelida.
• Comparative account of excretory, respiratory and reproductive systems.
• Regeneration and sexual reproduction.

Unit-II
Nemertine or Rhyncocoela
• General organisation and classification.
• Life history of a typical nemertine.
• Affinities of the group.
Nematomorpha
• General organisation and classification.
• Life history of a typical nematomorph.
• Affinities of the group.

Unit-III
Acanthocephala
• General organisation and classification.
• Life history of a typical Acanthocephala.
• Affinities of the group.

Rotifera
• General organisation and classification.
• Life history of a typical Acanthocephala.
• Affinities of the group.

Unit-IV
Other Minor Phyla
• General organization, classification, development and ecology of the animals belonging to
  the following minor phyla:
  • Gastrotricha
  • Kinorhyncha,
  • Bryozoa
  • Brachiopoda
• Comparative account of body wall, digestive, circulatory and nervous system.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and
one compulsory question of short answer type covering the whole syllabus. It will consist of eight
short answer type questions of 1\(\frac{1}{2}\) marks each. Students will attempt one question from each unit
and the compulsory question. All questions carry equal marks.

(Annelida and Minor phyla)
Annelida
• Dissection of Nereis, earthworm and leech.
• Study of T.S. of various annelids.
• Preparation of permanent slides of the various structures such as parapodia and nephridia.
General survey of Annelida.
Nemertine or Rhynchocoela
• Study of the specimens from museum and mounted slides representing families as prescribed from the theory.

Nematomorpha
• Study of *Gordius* from specimen and prepared slides.

Acanthocephala
• Study of the specimens from museum and mounted slides representing families as prescribed from the theory: *Echinorhynchus, Macracanthorhynchus, Centrorhynchus*.
• Making permanent stained preparation of the acanthocephalans from crows and frogs etc.
• Histology of Acanthocephala from the slides.

Other Minor Phyla
• Identification of museum specimens and permanent mounts from various minor phyla as per the theory course.
• Temporary preparations of permanent mounts of the animals or their parts from the above phyla.

Books Recommended

( Mollusca and Echinodermata )

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Objectives
• To acquaint the students with the variety of non-chordates from Mollusca and Echinodermata and to study their functional anatomy.
• To enable the students to understand the differences in the morphology and general anatomy of molluscs and echinoderms and to classify and study their general characters.

Unit-I

Mollusca
• General organisation and classification of Mollusca up to orders.
• Comparative account of :
  (i) Digestive system
  (ii) Nervous systems and sense organs
  (iii) Reproductive system
  (iv) Respiratory system
  (v) Circulatory system
  (vi) Excretory system
Unit-II

• Shell and its development
• Torsion and detorsion in gastropods
• Organs of locomotion
• Different types of larvae

Unit-III

Echinodermata

• General organization, classification, development and ecology of important animals belonging to the five different classes of the phyla i.e. Asteroidea, Echinoidea, Holothuroidea, Crinoidea and Ophiuroidea.
• Comparative account of the larvae.

Unit-IV

• Development of internal organs and metamorphosis.
• Affinities of the group.
• Important fossil forms.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1½ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Books recommended


Practical Paper VIII : Zoology X– Functional Anatomy of Non-Chordates-VI

(Mollusca and Echinodermata)

Mollusca

• General survey of molluscs by the study of specimens and slides.
• Study of permanent slides and preparation of permanent stained slides of various forms from various classes.

Echinodermata

• General survey of echinoderms by the study of specimens and slides.
• Study of permanent slides and preparation of permanent stained slides of various forms from various classes.
ZOOLOGY SUBSIDIARY
Zoology-IV (Biodiversity: Chordates-II)

### Total Marks
- **Theory**: 75
- **Practical**: 25
- **Internal Ass.**: 15
- **Annual Exam.**: 60

### Theory hours per week: 4
### Practical hours per week: 4

### Objectives
To acquaint the students about the structure and function of chordates and to make the student understand the basic characters, advancements and adaptations of different types of vertebrates.

Detailed study (morphology & anatomy), systematic position, distinctive characters, distribution, ecology, economic importance, if any, of the following animals:

#### UNIT-I
- **Aves**: *Columba*

#### UNIT-II
- **Mammalia**: *Oryctolagus*

#### UNIT-III
- **Ecology**: Definition, subdivisions and scope of ecology, Ecosystem- Definition, components and functioning of pond ecosystem; Food chain and food web; concepts of ecological niche; Ecological adaptations- Aquatic, Volant and desert adaptations.

#### UNIT-IV
- **Behaviour**: Parental care, migration with particular reference to Fishes and birds.
- **Physiology**: Introduction to the physiology, physiology of digestion, circulation, respiration, conduction of nerve impulse and muscle contraction. Introduction to endocrinology with detailed account of hormones.

Note: Examiner will set a total of **nine** questions comprising **two** questions from each unit, and **one compulsory question** of short answer type covering the whole syllabus. It will consist of **eight short answer questions** of 1½ marks each. Students will attempt **one** question from each Unit and the **compulsory questions**. All questions may carry equal marks.

### Book Recommended

Practical: Zoology-IV (Biodiversity : Chordates-II)

Marks : 25
Internal Ass. : 05
Annual Exam.: 20

1. Chick- Digestive, arterial, venous and reproductive system.
2. Rat- digestive, arterial, venous and reproductive system.
3. To study prepared slides of developmental stages in the life history of chick upto 24hrs stage.
4. To study skeletons of Gallus and Oryctolagus.
5. General survey and classification upto orders, habitat, habits, external characters and economic importance (if any) of the following animals:
   Aves- Anas, Ardea, Milvus, Pavo, Tyto, Alcedo, Eudynamis, Casuarius; and Struthio.
6. Physiology:
   a. Diffusion and dialysis through Cellophane/dialysis Membrane.
   b. Effect of isotonic, hypotonic and hypertonic solutions on erythrocytes.
   c. Demonstration of the different types of human blood groups.
   d. Estimation of haemoglobin percentage in the human blood.
   e. Study of the sections of thyroid, pancreas, adrenal and ovary (corpus luteum) of mammal from the prepared slides.

Note: The candidates are required to submit duly signed note books of practical record and the prepared slides.
OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR
B.Sc. (Honours School) - Zoology
THIRD YEAR (FIFTH SEMESTER) EXAMINATION
OUTLINES OF TESTS

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<tr>
<td>Paper-VII</td>
<td>Comparative anatomy of Vertebrates -I and Zoogeography</td>
<td>100</td>
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<td>Paper-VIII</td>
<td>Cell Biology</td>
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<td>Paper-IX</td>
<td>Animal Physiology</td>
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<tr>
<td>Paper-X</td>
<td>Taxonomy, Ecology and Palaeontology-I</td>
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**Total:** 500

**Paper VI: General Account of Vertebrates (Fishes, Amphibians and Reptiles) - I**

<table>
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<td>Annual Exam : 20</td>
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**UNIT-I**

**Fishes**

Form and locomotion: Body form in various groups of fishes (cartilaginous and bony fishes). Locomotion: Passive and active locomotion (body muscles, fins and other miscellaneous methods).

Body coverings: Scales, types (placoid, Cosmoid, ganoid, cycloid, cteneoid), functions and modifications.

Fins: Structure of typical fin of a bony fish, paired fins, unpaired fins and the modifications of the fins.

Buoyancy: Structure of swim bladder, variations of swim bladder in different groups of fishes, functions of swim bladder. Weberian ossicles and swim bladder.

**UNIT-II**

**Fishes**

Respiration: Structure of typical gill, types and variations of gills in various groups of fishes, air breathing organs in fishes.
Age determination and growth in fishes, age determination in Indian freshwater fishes using hard parts (scales, vertebrae, opercular bones etc.) Growth measurements using Fraser-Lee equation.

Reproduction: Breeding behaviour, breeding and migration in *Salmon* and *Anguilla*.

**UNIT-III**

**Amphibia**

Classification upto orders (only living forms), general characters and peculiar features of the class Amphibia; adaptive radiations in Amphibia; morphological and physiological adaptations; parental care and neoteny in Amphibia; migration in Amphibia.

**UNIT-IV**

**Reptilia**

Classification upto orders (only living forms) of class Reptilia, general, distinctive peculiar features of the class Reptilia; adaptative radiations in Reptilia; shell in Chelonia; epidermal and dermal Plates and modifications in various families; identification of poisonous and non-poisonous snakes, poison apparatus, fangs and physiology of poison and its treatment. Jacobson’s organs. Affinites of Reptiles.

**Note:** - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1 1/2 marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

**Practical:**

- Dissection of a bony fish: Alimentary canal, cranial nerves, afferent and efferent vessels, reproductive organs.
- Weberian Ossicles of bony fishes: Air breathing organs of bony fishes.
- Variations in the body form and fins in fishes.
- Study of different types of scales in fishes, permanent preparations of scales.
- Museum specimen: Study of museum specimens belonging to different groups with classification, morphological characters and ecological notes.

**BOOKS RECOMMENDED**

Paper VII: Comparative Anatomy of Vertebrates - I and Zoogeography

Objectives
To enable the students to draw a comparative account of the morphology and general anatomy of the vertebrates and to understand evolution of different system in vertebrates. To enable the students understand the scope and importance of zoogeography.

UNIT –I

Integument: Basic microscopic structure in different groups, types of integumentary glands and their functions.

Exoskeleton: A general account of scales in the vertebrates, morphology of horn, antlers, feathers and hair.

UNIT –II

Endoskeleton: Chondrocranium, Splanchnocranium, modification of visceral arches, Jaw suspension, Dermatocranium.

UNIT-III

Zoogeography.
Scope and importance of zoogeography.

Zoogeography, divisions and the distribution of the vertebrates in the Palaearctic, Oriental, Ethiopian, Nearctic, Neotropical and Australian regions.

UNIT-IV

Island faunas: Recent continental island, Fringing Archipelagos and other islands and archipelagos.

Dispersal and migration of vertebrates.

Continental drift theory, Gondwana Mass and its dismemberment.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of $1\frac{1}{2}$ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.
Practical
1. Permanent Slides: Study of histology of integument of different vertebrates from museum slides.

Zoogeography:
3. Study of the world maps to draw political, physical, climatical, vegetational and animal distribution in them.
4. Study of continental shelves of various parts of the world to determine land connections with various island of the world.
5. Map study of continents in relations to distribution of animals peculiarities.
6. To draw line maps and fill in names of important animals, vegetation and climate

Books Recommended
5. Chordate Morphology by M. Jolly, Van Nostrad, USA.
6. Wildlife in India by Saharai, Bishan Singh Mohinder Singh, Dehradun, India.

Paper VIII: Cell Biology

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Total Marks : 100
Theory : 75
Internal Ass. : 15
Annual Exam : 60
Practical : 25
Internal Ass. : 05
Annual Exam : 20

Objectives
To enable the students to learn various aspects of cell biology.

UNIT I
Differentiations at cell surface: Microvilli, Tight junctions, Desmosomes etc.
Endoplasmic reticulum: Morphology, Chemical composition, morphological differentiation, functions and its role during mitosis.
Microbodies: Structure, chemical composition, functions and origin of peroxisomes and glyoxysomes.
UNIT-II
Mitochondria: Morphology including vital examination, light and ultramicroscopic structures, structural variations with regard to functions, chemical composition, role in cell physiology, mitochondria as semi-autonomous organoids.
Lysosomes: Morphology, chemistry, their polymorphism in relation to cytosis, cell ageing and cell autophagy.

UNIT-III
Nucleus: Nuclear envelope, nuclear permeability, structure of interphase nucleus, structure and cytochemistry of nucleus, structure and biogenesis of ribosomes.

Centrioles: Basal bodies, cilia, flagella, microtubules, amoeboid movement.

UNIT-IV
Golgi complex: Morphology, chemical composition, relationship with other cell components, its function with special reference to cell secretion.

Ultrastructure of typical sperm of insect.

Vitellogenesis in insects.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1 1/2 marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practicals based on Theory Paper BZO 3003 (BZO 3053)

1. Carbohydrates: Basis of PAS and staining with PAS.
2. Proteins: Basis of Mercuric-bromophenol blue and staining of proteins with Hg-BPB.
3. Lipids: Basis of Sudan black B and Nile blue sulphate methods and staining of acids and neutral lipids with the help of SBB and NBS techniques.
4. Nucleic acids: Basis of Feulgen’s and Methyl green/pyronin G and staining of nucleic acids with Feulgen and MG/PG techniques.
5. Smear preparation of testes of insects or mammalian semen.
6. Study of slides of insect and mammalian testes showing different stages of spermatogenesis.
7. Study of slides of ovaries of insects, birds and mammals showing various stages of Oogenesis.

Books recommended

Paper IX: Animal Physiology

Total Marks : 100
Theory : 75
Internal Ass. : 15
Annual Exam. : 60
Practical : 25
Internal Ass. : 05
Annual Exam : 20

Objectives

To make the students understand the physiological processes going on inside the vertebrates.

UNIT-I
Digestion: Intracellular and extracellular digestion, digestive enzymes, digestion by means of symbionts, coordination of digestive enzymes, intestinal absorption.

UNIT-II
Respiration: Nature of respiratory organs, transport of respiratory gases, respiratory quotient and caloric equivalent of oxygen, control of respiration.

Muscle: Muscle contraction – physiology and chemistry.

Nitrogen excretion: Chemical nature of nitrogenous products, distribution of excretory products of protein metabolism, mechanism and control of excretion.

UNIT-III
Circulatory System: Blood components, functions of components, cardiac output and heart rate, physiology of heart, control of cardiovascular function.

UNIT-IV
Nervous system: Structural elements, nerve impulse, resting and action potentials, conduction of action potential, synaptic transmission.

Reproduction: Structure of gonads and physiology of reproduction.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1½ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practical based on Theory Paper -IX

Physiology

1. Identification of food stuffs-starch, sucrose, glucose, proteins and fats.
2. Demonstration of osmosis and diffusion.
3. Demonstration of the presence of amylase enzyme in saliva. Effect of pH and temperature on enzyme action.
4. Determination of coagulation and bleeding time of blood.
5. Determination of blood groups of human blood samples.
6. Recording of blood pressure of man.
7. Innumeration of red blood corpuscles and white blood corpuscles of man.
8. Estimation of haemoglobin content in blood.

Books Recommended


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Objectives

To enable the students to identify, classify and name the organism according to international code of zoological nomenclature. To acquaint the student with different procedures of taxonomy and different methods of analysis of variations and theories of classification. To educate the students about the basic environmental phenomena like ecosystem, energy flow through the ecosystem and biogeochemical cycles. To enable the students understand the adaptations of the animals to their environment. To make the students understand the importance of Palaeontology with special reference to the fossils, dating of fossils and geological time scale. To acquaint the students with origin of different vertebrates and ancestries of some vertebrates.

UNIT-I
Definitions and perspectives of systematics, classification and taxonomy; history, goals and importance of taxonomy; procedures of taxonomy-identification, classification, nomenclature, phena, taxa, category; key and its significance; higher taxa and linnean hierarchy; qualitative and quantitative methods of analysis of variations; history and theories of classification; international code of Zoological nomenclature-principles and objectives and rules for nomenclature, typesystem and priority for different taxa.

UNIT-II
Introduction to Ecology-Definition, subdivision of ecology and scope of ecology. Ecological Factors-Temperature and light as ecological factors. Ecosystem - Definition, components of ecosystem, Grazing and detritus type of food chain, Food Web and Trophic levels. Ecological pyramids-Pyramids of number, biomass and energy.

UNIT-III
UNIT –IV
Introduction to Palaeontology: History, Stratigraphy; Principles, Importance and Successive stratigraphic steps, Fossils, importance and dating of fossils, Geologic time Scale, General account of Palaeo-Meso-and Cenozoic Eras with a mention of important fossil groups in different Eras, periods and epochs.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1½ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practicals
1. Study of components of ecosystem and ecological pyramids.
2. Use of keys to various taxa from different orders of animals. Methods of describing animals with particular reference to the recording of taxonomic characters.
3. Study of Fossils and their models.
4. Study of some charts relevant to Palaeontology.
5. Study of models of dinosaurs.
7. Visit to Fossil Park, Saketi, Kalaamb (H.P.)

Books Recommended
OUTLINES OF TESTS, SYLLABUS AND COURSES OF READING FOR
B.Sc. (Honours School) - Zoology
THIRD YEAR (SIXTH SEMESTER) EXAMINATION
OUTLINES OF TESTS

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<td>Paper-XII</td>
<td>Comparative anatomy of Vertebrates – II</td>
<td>100</td>
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<tr>
<td>Paper-XIII</td>
<td>Cytogenetics</td>
<td>100</td>
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<tr>
<td>Paper-XIV</td>
<td>Embryology and Endocrinology</td>
<td>100</td>
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<td>Paper-XV</td>
<td>Taxonomy, Ecology and Palaeontology-II</td>
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**Paper XI: General Account of Vertebrates (Aves and Mammals) –II and Wild life**

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**Objectives**
To acquaint the students with the classification and general characters including morphology and physiology of Aves and mammals including their behaviour and physiological adaptations. To educate the students about the importance of wildlife conservation.

**UNIT-I**

**Aves**
Classification upto orders, general characters and peculiar features of the class Aves. Detailed account of Ratitae; migration in birds; beaks & feet in birds; aerodynamics of flight in Aves. Adaptive radiations and affinities of class Aves.

**UNIT-II**

**Mammals**

**UNIT – III**

**Wild Life**

Wildlife habitat with particular reference to food, shelter and water requirements, Biotic succession and wildlife, successional classification of wildlife.
UNIT-IV

Wild Life

Methods of studying wildlife, Government and non-government organisations of wildlife. Law and legislation regarding wildlife.

Special projects for endangered species (a) Project tiger, (b) Gir Lion Sanctuary Project, (c) Crocodile Breeding Project and (d) Project Hangul.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1 1/2 marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practicals

1. Study of the birds of Panjab University Campus alongwith their roosting and nesting sites.
2. Study of the winter migratory birds of Sukhna Lake, Chandigarh.
3. Study of the wild animals both in nature and Captivity of Chhatbir Zoo near Chandigarh.
4. Visit to Pinjore Garden to study wild animals in nature and Captivity.
5. Visit to Kansal Sanctuary to study the wildlife.

Vertebrates

Museum specimens: Study of museum specimens belonging to different groups with classification, morphological characters and ecological notes.

Books Recommended

Objectives
To enable the students to draw a comparative account of the morphology and general anatomy of the vertebrates and to understand evolution of different system in vertebrates.

UNIT-I

UNIT-II
Respiratory system: A general account of the respiratory system in vertebrates.

Circulatory system: Formation and evolution of heart, aortic arches and their significance.

UNIT-III
Receptor organs: Organs of hearing and sight in vertebrates.

UNIT-IV
Urinogenital system: Types of kidney-Archinephros, Mesonephros, Metanephros, urinary bladder.
Reproductive organs: Gonads, ducts and their modifications in males and females in the vertebrates group. Uteri in mammals.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1½ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practical
Histological slides available in museums with respect to different systems.
Dentition of vertebrates.
Dissections: Study of Blood vascular system of Gallus; air sacs, muscles of flight and pectin of Columba (Through models and charts). Neck nerves, blood vascular and reproductive systems of Rattus (Rat).
Books Recommended


Paper XIII: Cytogenetics

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Objectives
To enable the students to learn various aspects of cytogenetics. To give an insight into evolution of genetic material, its functional aspects and changes in the environment that bring about evolution.

UNIT-I
Physical basis of heredity – Mendelism, interaction of genes, multiple alleles, chromosome structure and function in Eukaryotes (except in chemistry, models and concepts). Polytene chromosomes, lampbrush chromosomes.

UNIT-II
Cell division _Mitosis & Meiosis.
Sex determination-Sex chromosomes & sex chromatin, different types of sex mechanisms.

UNIT-III
Chromosome changes- Structural aberrations and its significance. Numerical changes, polyploidy and its types.
Nature of genes-Double helix structure of DNA, mechanisms of DNA replication.
Changes in genes-Spontaneous mutations and induced Mutations, physical and chemical mutagens.

UNIT-IV
Linkage of genes, crossing over, sex linkage in Drosophila and man, criss-cross inheritance, colour blindness and haemophilia.
Cytoplasmic inheritance.

Human Genetics-Normal and abnormal karyotypes.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1½ marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.
Practicals

1. Study of mitosis from onion root tips by making temporary squash preparations and staining with aceto carmine/aceto orcein.
2. Study of chromosomes (meiosis and mitosis) from the testicular tissue of Chrotogonous (grasshoppers)/cockroach etc.
   (i) By squash method using Aceto-orcein stain.
   (ii) By air drying technique using acetic acid dissociation technique and staining with Geimsa or Feulgen.
4. Mammalian blood smear preparation for the study of drum sticks as sex chromatin test (rat or human).
5. Study of sex chromatin from human buccal mucosa.
6. Study of metaphase karyotypes from permanent/temporary slides of invertebrate and vertebrate species such as beetles, mosquitoes, grasshoppers, flies, spiders, man, rat, mice and bat etc. plus numerical or structural aberrations, if any.
7. Study of Mendelian ratios from the study of seed coat colour pattern of bean seeds (Monohybrid and Dihybrid ratios).
8. Survey of human subjects for the demonstration of the frequency of dominant and recessive traits such as free and attached pinna, rolling of tongue, eye colour, hair colour etc.
9. Screening of films of Heredity, gene expression, DNA structure/cell division etc. available in the Department.

Books recommended

5. Gupta P.K., Genetics, Rastogi Publishers, Meerut, 2011

Paper XIV: Embryology and Endocrinology

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<th>Theory hours per week</th>
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Objectives
To enable the students to know about the development of all the vertebrates from an egg to the embryo. To acquaint the students with the functions of various endocrine glands and their secretions i.e. hormones.
UNIT I
History, Problems and Scope : Types of eggs; fertilization, early development (cleavage, blastulation, gastrulation and tubulation), presumptive areas, organisers and inductors.

UNIT II
Development of membranes and formation of placenta. Types of placentae in mammals, pregnancy tests. Bio-chemical basis of embryology, regeneration, metamorphosis.

UNIT-III
Introduction to hormones and their mode of action.
Gonadal hormones in Mammals.
Hormonal control of metabolism, development, somatic pigmentation and reproduction in insects.

UNIT-IV
Structure of endocrine glands-pituitary, thyroid, adrenal and pancreas of vertebrates.

Biological actions of hormones of pituitary, thyroid, adrenal and pancreas.

Note: - Examiner will set a total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering the whole syllabus. It will consist of eight short answer type questions of 1 1/2 marks each. Students will attempt one question from each unit and the compulsory question. All questions carry equal marks.

Practicals

Embryology
1. Study of the development stages of Frog starting from fertilized egg upto tadpole stage.
2. Study of the slides showing the development of frog from zygote upto 7mm embryo.
3. Making stained permanent preparations of the blastodiscs from 18 to 90 hours incubated chick eggs.
4. Study of the whole mounts of the blastodiscs of 18 to 90 hours age.
5. Study of the slides of Amphioxus and Herdmania larvae.

Endocrinology
1. Localization of endocrine glands in rat.
2. Study of the estrous cycle in mice/rat.
3. Study of the microscopic structure of endocrine glands-thyroid, pancreas, ovary, testes, adrenal and pituitary.

Books Recommended
Paper – XV : Taxonomy, Ecology & Palaeontology-II

Total Marks: 100
Theory: 75
Internal Ass.: 15
Annual Exam: 60
Practical: 25
Internal Ass.: 05
Annual Exam: 20

Objectives

To enable the students to identify, classify and name the organism according to international code of zoological nomenclature. To acquaint the student with different procedures of taxonomy and different methods of analysis of variations and theories of classification. To educate the students about the basic environmental phenomena like ecosystem, energy flow through the ecosystem and biogeochemical cycles. To enable the students understand the adaptations of the animals to their environment. To make the students understand the importance of Palaeontology with special reference to the fossils, dating of fossils and geological time scale. To acquaint the students with origin of different vertebrates and ancestries of some vertebrates.

UNIT-I

Population structure of species; polytypic species, race, variety, cline, subspecies, semispecies, super species; speciation, species concepts-Typological species concept, nominalistic species concept, biological species concept, evolutionary species concept; difficulties in applying biological species concept.

UNIT-II

Population – Characteristics of a population, interspecific relationships (positive, negative and neutral relationships).

UNIT-III


UNIT-IV


Practicals

1. Phototactic behaviour of an insect.
2. Geotactic behaviour of an insect/annelid.
3. Food preferences in insects/larvae.
4. Habituation response in mosquito larvae.
5. Study of population, association and inter specific relationships.
6. Ecological adaptations through specimens, models and charts.
Study of models of ancestry of Elephant.
Study of some charts relevant to Palaeontology.
Visit to Chhatbir Zoological Park.

Books Recommended