File No: 6-38/2006(Hons)HPU(Acad)  
Himachal Pradesh University  
"Academic Branch"  

Dated: Shimla-5, the

To

1. All the Principals of the Govt/Colleges of H.P.
2. The Dean, Faculty of Life Sciences, HPU, Shimla-5.
3. The Chairman, Deptt. of Zoology, HPU, Shimla-5.
4. The Director, H.P.U Regional Centre Dharamshala.
5. The Controller of Examination, HPU, Shimla-5.
6. The D.R. Exam (UG) HPU, Shimla-5.
8. The D.R. Secrecy, HPU, Shimla-5.

Subject: Supply of Syllabus of B.Sc Zoology (Hons) for Under Graduate Classes.

Sir/Madam,

I am sending herewith a complementary copy of new/revised syllabus of B.Sc Zoology (Hons) duly approved by the Board of Studies(UG) and faculty of Life Science in its meeting held on 14-11-2011. Further Academic Council Vide item No -22 in its meeting held on 24-11-2011 approved the same which will be implemented in phased manner from the academic session 2012-2013 onwards.

Encls: As Above

Yours Faithfully,

Deputy Registrar (Acad)  
H.P. University, Shimla-5
ANNEXURE-A

B. Sc. I (HONORS IN ZOOLOGY)

Course-I: Invertebrates-I:

Section-A:
- Introduction to Non-Chordata = 04 hours
- Protozoa = 22 hours
- Porifera = 08 hours

Section-B:
- Cnidaria = 18 hours
- Ctenophora = 08 hours

Total = 60 hours

Course-II: Invertebrates-II:

Section-A:
- Platyhelminthes = 12 hours
- Nematodermatidae = 18 hours

Section-B:
- Annelida = 30 hours

Total = 60 hours

Course-III: Invertebrates-III:

Section-A: Arthropoda = 30 hours
Section-B: Mollusca = 20 hours
Echinodermata = 10 hours

Total = 60 hours

Course-IV: Chordata-I:

Section-A = 10 hours
Section-B = 12 hours
Section-C = 19 hours
Section-D = 19 hours

Total = 60 hours

B. Sc. II (HONORS IN ZOOLOGY)

Course-IV: Chordata-II:

Section-A = 10 hours
Section-B = 12 hours
Section-C = 19 hours
Section-D = 19 hours

Total = 60 hours
### Course-V: Chordata-II:
- Section-A: Cell Biology = 15 hours
- Section-B: Developmental Biology = 15 hours
- Section-C: Evolution = 15 hours
- Section-D: = 15 hours
  **Total = 60 hours**

### Course-VI: General Zoology:
- Section-A: Cell Biology = 20 hours
- Section-B: Developmental Biology = 22 hours
- Section-C: Evolution = 18 hours
  **Total = 60 hours**

### Course-VII: Molecular Biology and Biotechnology:
- Section-A = 20 hours
- Section-B: = 22 hours
- Section-C: = 18 hours
  **Total = 60 hours**

### B.Sc. III (HONORS IN ZOOLOGY)

#### Course-VII: Biochemistry:
- Section-A: = 32 hours
- Section-B: = 28 hours
  **Total = 60 hours**

#### Course-VIII: Mammalian Physiology:
- Section-A: = 34 hours
- Section-B: = 26 hours
  **Total = 60 hours**

#### Course-IX: Applied Zoology and Environmental Biology:
- Section-A: = 34 hours
- Section-B: = 26 hours
  **Total = 60 hours**

#### Course-HS-III: Medical Zoology and Environment Management:
- Section-A: = 34 hours
- Section-B: = 26 hours
  **Total = 60 hours**
### First Year Examination

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Time</th>
<th>Total Marks</th>
<th>Internal Assessment (marks)</th>
<th>Pass Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Invertebrates-I</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
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<tr>
<td>II</td>
<td>Invertebrates-II</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>III</td>
<td>Invertebrates-III</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>HS-I</td>
<td>Cytogenetics &amp; Immunology</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Practical</td>
<td>Two Sessions</td>
<td>2½ hrs. each (5 hrs.)</td>
<td>50</td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

- Total Marks: 210
- Pass Percentage: 40%

### Second Year Examination

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<th>Pass Percentage</th>
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</thead>
<tbody>
<tr>
<td>IV</td>
<td>Chordata-I</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
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<tr>
<td>V</td>
<td>Chordata-II</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>VI</td>
<td>General Zoology</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>HS-II</td>
<td>Molecular Biology and Biotechnology</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
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<tbody>
<tr>
<td>VII</td>
<td>Biochemistry</td>
<td>3 hrs</td>
<td>40</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>VIII</td>
<td>Mammalian Physiology</td>
<td>3 hrs</td>
<td>40</td>
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<td>Applied Zoology and Environmental Biology</td>
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<td>Medical Zoology and Environment Management</td>
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</table>

- Total Marks: 210
- Pass Percentage: 40%
B.Sc. (Hons) Zoology (First Year)

Paper: HS-I (Cytogenetics and Immunology)

M.M. : 40
Duration: 60 hrs

Note for examiners and students

1) Examiner will set Nine questions in all, selecting Four questions from each section of the syllabus, and one consisting of eight short questions will be set to cover the entire syllabus and that will be compulsory.

2) The candidates will be required to attempt five questions in all i.e. selecting atleast two question from each section.

3) All questions carry equal marks.

4) Pass percentage is 40% but to get hon's degree the aggregate percentage should be 50 percent.

SECTION - A CYTOGENETICS (30 hrs)

General Introduction and Mendelian Genetics
Mendel's experiments, Principle of segregation, Principle of Independent assortment
Interactions of genes (6 hrs)

Linkage, Crossing over and Chromosome mapping:
Linkage and linkage groups, Complete and incomplete linkage, Cytological basis of crossing over, Construction of chromosomes maps (6 hrs)

Sex determination:
Chromosome theory of sex determination, Genetic Balance theory, Cytoplasmic sex determination (4 hrs)

Sex linked inheritance:
Sex linked inheritance in Drosophila and man, Sex limited and sex influenced genes (3 hrs)

Extrachromosomal inheritance
Criteria for cytoplasmic Inheritance, Examples of cytoplasmic Inheritance (3 hrs)

Mutations
Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations, Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method, DNA repair mechanisms (8 hrs)

SECTION B- IMMUNOLOGY (30 hrs)

Components of immune system
Innate, Adaptive (cell mediated and humoral) - Passive: Artificial and Natural Immunity, Active: Artificial and Natural Immunity, (3 hrs)

Cells and Organs of the Immune System
Hematopoiesis and role of hematopoietic factors, Cells of the immune system, Organs of the Immune system, Primary and Secondary lymphoid organs, Lymphatic system (4 hrs)

Antigens
Antigenicity and immunogenicity, Immunogens, Adjuvants and Haptens, Factors influencing immunogenicity, B and T-cell epitopes (2 hrs)
Immunoglobulins
Structure and Functions, Basic structure, deducing antibody structure, classes and function, Antigenic, determinants on immunoglobulins, Antigen-antibody interactions, Polyclonal sera, Monoclonal antibodies, Hybridoma technology. (5 hrs)

Major Histocompatibility Complex
Structure, polymorphism and functions, MHC and immune responsiveness. (2 hrs)

Antigen Processing and Presentation
The cytosolic pathway: endogenous pathway and the endocytic pathway and exogenous pathway. (3 hrs)

Immune Effectors Mechanisms
Cytokines: properties and functions, general structure of cytokine receptors, Complement system: components, activation and functions. (4 hrs)

Hypersensitivity
Gell and Coombs classification, IgE mediated (type I), antibody mediated (type II), Immune complex mediated, (type III) and T-DTH mediated hypersensitivity (type IV). (4 hrs)

Imune System in Health & Disease
Vaccines: bacterial, viral, toxoid and III generation vaccines, Immunodeficiency, Autoimmunity. (3 hrs)

Suggested Reading Material: (cytogenetics)

Suggested Reading Material (Immunology)
B.Sc. (Hons) Zoology (Second Year)

Paper: HS-II (Molecular biology and Biotechnology)

M.M. : 40

duration: 60 hrs

Note for examiners and students

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SECTION – A MOLECULAR BIOLOGY (30 hrs)

Mechanism of Transcription
RNA Polymerase and the transcription unit, Transcription in Prokaryotes, Transcription in Eukaryotes

RNA Modifications
Split genes, concept of introns and exons, removal of Introns, spliceosome machinery, splicing pathways, alternative splicing, exon shuffling, RNA editing, and mRNA transport.

Translation

Transcription Regulation in Prokaryotes
Principles of transcriptional regulation, regulation at initiation with examples from lac and trp operons

Transcription Regulation in Eukaryotes
Conserved mechanism of regulation, Eukaryotic activators, Signal integration, combinatorial control, transcriptional repressors, signal transduction and control of transcriptional regulator. Gene Silencing

Regulatory RNAs
Riboswitches, RNA interference, miRNA, siRNA, Regulatory RNA and X-inactivation

SECTION B – BIOTECHNOLOGY (30 hrs)

Introduction
Concept and scope of biotechnology, Tools and techniques in biotechnology.

Animal Cell and Tissue Culture
Cell culture media (natural and defined), Preparation and sterilization, Primary cell culture, Cell lines, Pluripotentstem cells, Cryopreservation of cultures.
Molecular Techniques in Gene manipulation
Introduction to the concept of Recombinant DNA Technology, Cloning vectors, Restriction and modifying enzymes, Transformation techniques (microbial, plants and animals), Construction and screening of DNA libraries, Molecular analysis of DNA, RNA and Proteins (i.e. Southern, Northern and Western blotting), DNA sequencing (Maxam-Gilbert and Sanger methods), Polymerase chain reaction and DNA microarrays.

Transgenic Animal Technology
Production of transgenic animals—nuclear transplantation, Retroviral method, DNA microinjection method, Applications of transgenic mice, sheep, goat, pig, birds and fish, Dolly and Polly. Scientific significance, Therapeutic applications, Human cloning. Ethical issues of transgenic animals.

Applications of Biotechnology
Molecular diagnosis of genetic diseases (Cystic fibrosis, Huntington’s disease, Sickle cell anemia), RFLP, RAPD and , Vaccines and therapeutic agents, Recombinant DNA in medicines (recombinant insulin and human growth hormone), Gene therapy, Enzymes in detergents and leatherindustries, Heterologous protein production, Bioremediation.

Patenting & Biosafety
Intellectual property rights, Biosafety levels and guidelines.

SUGGESTED BOOKS (Molecular Biology)

SUGGESTED BOOKS (Biotechnology)
B.Sc. (Hons) Zoology (Third Year)

Paper: HS-III (Medical Zoology and Environment Management)

M.M. : 40 duration: 60 hrs

Note for examiners and students

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3) All questions carry equal marks.

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SECTION A - MEDICAL ZOOLOGY (30 hrs)

Reproductive Health
Implantation and placental physiology in pregnancy; placental secretions and their regulation; Health and Diseases during pregnancy.
Infertility in male and female: cause, diagnosis and management
Assisted Reproductive Technology, Sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, IFT, IUI, ZIFT, GIFT, ICSI, PROST. Modern contraceptive technologies: Demographic terminology used in family planning. (12hrs)

Human Welfare
Bionomics and control of crop pests: *Earias vittella*, *Pectinophora gossypiella*, *Heliothis armigera*. Bionomics of the following stored grain pests and their management for control: *Corcyra cephalonica*, *Trogoderma granarium*, *Callosobruchus chinensis*.
Insect control: Mechanical, cultural and biological.
Classification of insect control with reference to chlorinated hydrocarbons, organophosphates, carbamates and synthetic pyrethroids.
General aspects of Integrated Pest Management (IPM). (12hrs)

Fish Technology
Zebrafish as a model for biotechnology, Genetic improvements in aquaculture industry. Induced breeding and transportation of fish seed. (6hrs)

SECTION B - ENVIRONMENT MANAGEMENT (30 hrs)

Introduction:
Man as a biological species in the ecosystem; population increase; carrying capacity, exploitation of resources due to activities like agriculture, horticulture, urbanization and industrialization. Role of Government, NGO’s, International organizations, treaties and conventions. Environmental movements.
Definition; Brundlandt Report; Threats to sustainable development, green technologies, eco-cities, Ecological footprint, National Environmental Policy. (14hrs)

Conservation of resources
Soil – Contour farming, afforestation and reforestation; Water – Rainwater harvesting, aquifers, groundwater recharge, watershed management; Biodiversity – In-situ conservation (Sanctuaries,
National Parks, Biosphere Reserves, World Heritage Sites), Project Tiger and other conservation efforts. Social forestry and Joint forestry
Management; Ex-situ conservation (botanical gardens, gene banks, cryopreservation); Role of organizations like NBPG, BSI, ZSI, WWF. IUCN and conventions like Convention on Biological diversity; Ramsar Convention, National Action Plan on Conservation of Biodiversity; Environmental laws and acts.

SUGGESTED BOOKS (Medical Zoology)

SUGGESTED READINGS (Environment Management)
2. Mohapatra Textbook of Environmental Biotechnology IK publication.
4. Divan Rosencraz, Environmental laws and policies in India, Oxford Publication.
6. Rama SVS, Environmental pollution – Health and Toxicology, Narosa Publication.