

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

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Dated: Shimla-5, the

To

- Non Govt. Degree
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 Dharmashala.
 5. The Controller of Examination, HPU, Shimla-5.
 6. The D.R. Exam (UG) HPU, Shimla-5.
 7. The A.R. Eval. /Re/Eval/Conduct/Exams, 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

सिद्धा/अकादमिक (गोप)

SHIST
Lg
9/2/12

RR
9-02-12

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
Nemathelminthes	= 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: HS-I: Cytogenetics and immunology:

Section-A	= 30 hours
Section-B	= 20 hours
	= 10 hours
Total	= 60 hours

B.Sc. II (HONORS IN ZOOLOGY)

Course-IV: Chordata-I:

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	= 15 hours
Section-B	= 15 hours
Section-C	= 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-VI: HS-II: 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-III: HS-III: Medical Zoology and Environment Management:

Section-A	= 34 hours
Section-B	= 26 hours
Total	= 60 hours

B.Sc (Hons Course) –Zoology.
Scheme of Examination

First Year Examination

Paper	Subject	Time	Total Marks	Internal Assessment (marks)	Pass Percentage
I	Invertebrates-I	3 hrs	40	10	40
II	Invertebrates-II	3 hrs	40	10	40
III	Invertebrates-III	3 hrs	40	10	40
HS-I	Cytogenetics & Immunology	3 hrs	40	10	40
Practical	Two Sessions	2½ hrs. each (5 hrs.)	50		
			210	40	

Second Year Examination

Paper	Subject	Time	Total Marks	Internal assessment (marks)	Pass Percentage
IV	Chordata-I	3 hrs	40	10	40
V	Chordata-II	3 hrs	40	10	40
VI	General Zoology	3 hrs	40	10	40
HS-II	Molecular Biology and Biotechnology	3 hrs	40	10	40
Practical	Two Sessions	2½ hrs. each (5 hrs.)	50		
			210	40	

Third Year Examination

Paper	Subject	Time	Total Marks	Internal assessment (marks)	Pass Percentage
VII	Biochemistry	3 hrs	40	10	40
VIII	Mammalian Physiology	3 hrs	40	10	40
IX	Applied Zoology and Environmental Biology	3 hrs	40	10	40
HS-III	Medical Zoology and Environment Management	3 hrs	40	10	40
Practical	Two Sessions	2½ hrs. each (5 hrs.)	50		
			210	40	

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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 (6hrs)

Sex determination :

Chromosome theory of sex determination, Genetic Balance theory, Cytoplasmic sex determination

(4hrs)

Sex linked inheritance :

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

Extrachromosomal inheritance

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

Mutations

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Genemutations: 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. (8hrs)

SECTION B- IMMUNOLOGY (30hrs)

Components of immune system

Innate, Adaptive (cell mediated and humoral) - Passive: Artificial and Natural Immunity, Active: Artificial and Natural Immunity. (3hrs)

Cells and Organs of the Immune System

Haematopoiesis and role of haematopoietic factors, Cells of the immune system, Organs of the Immune system:, Primary and Secondary lymphoid organs, Lymphatic system. (4hrs)

Antigens

Antigenicity and immunogenicity, Immunogens, Adjuvants and Haptens, Factors influencing immunogenicity, B and T-cell epitopes. (2hrs)

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. (2hrs)

Antigen Processing and Presentation

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

Immune Effectors Mechanisms

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

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). (4hrs)

Immune System in Health & Disease

Vaccines: bacterial, viral, toxoid and III generation vaccines, Immunodeficiency, Autoimmunity. (3hrs)

Suggested Reading Material : (cytogenetics)

- Ayala, F. J. and Kiger, Jr. J. A. (1980). Modern Genetics. The Benjamin cummings Publishing Co. Inc.
- Brown, T. A. (1992). Genetics . A molecular approach , 2nd ed. Van Nostrand Rainhold (international).
- De-Robertis, F. D. P. and De-Robertis Jr., E. M.E. (1987). Essentials of cell and molecular biology, Saunders, Philadelphia.
- De-Robertis, F.D.P. and De-Robertis Jr. , E. M.E. (1987). Cell and Molecular Biology, Saunders, Phiadelphia.
- Friefelder, D. and Malacinski, G. M. (1993). Essentials of Molecular biology , Jones and Barlett Publishers, Boston.
- Gardener, E. J. , Simmons, M. T. J. and Sunstad, D. P. (1999). Principles of Genetics , 8th ed. John Wiley and Sons, New York.
- Miglani, G. S. (2000). Basic Genetics Narosa Publishing House, New Delhi.
- Sambrook, J., Fritish, E. F. and Maniatis, J. (1989). Molecular cloning. A lab manual.
- Winter, P.C., Hickey, G. J. and Fletcher, H. L. (1999). Instant notes in Genetics .New Delhi.
- Satson, J. D. et al (1987). Molecular Biology of Genes, 4th ed. Vol. I. and Vol. II. The Benjamin / Cummings Publishing Co. Inc.
- Weaver, R. F. and Hednick, P. W. (1992). Genetics Wm. C. Brown Publishers Dubuque.
- Zubay, U.G. (1987). Genetics . The cummings publishing Co. ,

Suggested Reading Material (Immunology)

1. Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006). VI Edition. Immunology. W.H. Freeman and Company.
2. Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006). XI Edition. Roitt's Essential Immunology

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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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- 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 MOLECULAR BIOLOGY (30 hrs)

Mechanism of Transcription

RNA Polymerase and the transcription unit, Transcription in Prokaryotes, Transcription in Eukaryotes (5hrs)

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. (5hrs)

Translation

Assembly line of polypeptide synthesis - ribosome structure and assembly, various steps in protein synthesis., Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides. Fidelity of translation. Inhibitors of protein synthesis. Regulation of translation, Translation-dependent regulation of mRNA and Protein Stability. (8hrs)

Transcription Regulation in Prokaryotes

Principles of transcriptional regulation, regulation at initiation with examples from *lac* and *trp* operons (3hrs)

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 (5hrs)

Regulatory RNAs

Riboswitches, RNA interference, miRNA, siRNA, Regulatory RNA and X-inactivation. (4hrs)

SECTION B – BIOTECHNOLOGY (30 hrs)

Introduction

Concept and scope of biotechnology, Tools and techniques in biotechnology. (4hrs)

Animal Cell and Tissue Culture

Cell culture media (natural and defined), Preparation and sterilization, Primary cell culture, Cell lines, Pluripotent stem cells, Cryopreservation of cultures. (5hrs)

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. (7hrs)

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. (5hrs)

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 leather industries, Heterologous protein production, Bioremediation. (7hrs)

Patenting & Biosafety

Intellectual property rights, Biosafety levels and guidelines. (2hrs)

SUGGESTED BOOKS (Molecular Biology)

1. Karp, G. 2010 Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006 Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene (6th edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

SUGGESTED BOOKS (Biotechnology)

1. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
2. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.
3. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- genes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.
4. Watson, J.D., Gilman, M., Witkowski, J. and Zoller, M., (1983) Recombinant DNA. II Edition. Freeman and Co., N.Y., USA.
5. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers.
6. Brown, T.A. (1998). Molecular biology Labfax II: Gene analysis. II Edition. Academic Press, California, USA.

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, IUT, 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 pyrethroid.

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 NBPGR, BSI, ZSI, WWF, IUCN and conventions like Convention on Biological diversity; Ramsar Convention, National Action Plan on Conservation of Biodiversity; Environmental laws and acts. (16hrs)

SUGGESTED BOOKS (Medical Zoology)

1. Park, K. (2007) Preventive and social medicine. XVI Edition. B.B Publisher.
2. Arora, D.R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributers.
3. Chaudhury, S.K. (1996) Practice of fertility Control, A Comprehensive Textbook. B.I.Churchill Livingston Pvt Ltd, India.
4. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher.
5. Hafez, E. S. E. and Evans, T. N. (1973). Human Reproduction: Contraception and Conception. Harper and Row, New York.
6. Atwal, A. S. (1993) Agricultural Pests of India and South East Asia. Kalyani Publishers, New Delhi.
7. Pradhan, S (1983) Insect Pests of Crops. National Book Trust, India.
8. Prost, P.J. (1962) Apiculture. Oxford and IBH, New Delhi.
9. Knobil, E. & Neill, J.D. (2006) The Physiology of Reproduction, Vol. 2, Elsevier Pub.
10. Srivastava, C.B.L. (1999) Fishery Science and Indian Fisheries. Kitab Mahal publications, India.
11. Dunham R.A. (2004) Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K

SUGGESTED READINGS (Environment Management)

1. Joseph, B., Environmental studies, Tata Mc Graw Hill.
2. Mohapatra Textbook of Environmental Biotechnology IK publication.
3. Thakur, I. S., Environmental Biotechnology, I K Publication.
4. Divan Rosencraz, Environmental laws and policies in India, Oxford Publication.
5. Michael Allabay, Basics of environmental science, Routledge Press.
6. Rana SVS, Environmental pollution – Health and Toxicology, Narosa Publication.
7. Miller, G.T. 2002. Sustaining the earth, an integrated approach. (5th edition) Books/Cole. Thompson Learning, Inc.
8. Chapman, J.L., Reiss, M.J. 1999. Ecology: Principles and applications (2nd edition) Cambridge University Press.
9. Ghosh, S.K., Singh, R. 2003. Social forestry and Forest Management. Global Vision Pub.
10. Sinha, S. 2010. Handbook on Wildlife Law Enforcement in