

**B.Sc. Part II Examination, 2015**  
**ZOOLOGY**

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There shall be three written papers of three hours duration each.

Theory		Marks
		(Min. Pass Marks; 54)
Paper I	: Chordate Structure and function	50
Paper II	: Developmental Biology	50
Paper III	: Immunology, Microbiology and Biotechnology	50
Practical	:	75
		(Min. Pass Marks; 27)
Duration of Theory examination		3 hours
Duration of practical examination		5 hours

*Note:* Each theory paper is divided in three parts i.e. Section-A, Section –B and Section –C.

Section-A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry of 1 mark.

Section –B: Will consist of 10 questions. Each unit will be having two questions; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question carries 3.5 Marks.

Section-C: will consist of total 05 questions. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question carries 7.5 Marks.

## PAPER I

### **Chordate Structure and Function**

- Unit 1: Classification and characters of phylum Chordata (excluding extinct forms) up to orders, Comparisons of habit, habitat, external features and anatomy of *Balanoglossus*, *Herdmania* and *Branchiostoma* (excluding development).
- Unit 2: Ascidian tadpole larva and its Metamorphosis, Affinities of Hemichordate, Urochordate and Cephalochordates, Habit, Habitat and salient features of Petromyzon, Ammocoete larva.
- Unit 3: Integument including structure and development of placoid scales, feathers and hairs, Jaw suspensorium, limbs and girdles of *Rana*, *Uromastix*, *Columba* and *Oryctolagus*.
- Unit 4: Heart and aortic arches, respiratory system and alimentary canal of *Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*.
- Unit 5: Brain, urinogenital system (*Scoliodon*, *Rana*, *Uromastix*, *Columba* and *Oryctolagus*), Identification of poisonous and non poisonous snakes. Biting mechanism in snakes, flight adaptations in birds. Adaptations in aquatic mammals.

## PAPER II

### **Developmental Biology**

- Unit 1: Formation of egg and sperm, vitellogenesis and fertilization. Types of eggs and sperms, parthenogenesis, regeneration.
- Unit 2: Planes and patterns of cleavage in chordates, significance of cleavage and blastulation, Morphogenetic cell movement, Fate maps and significance of gastrulation.
- Unit 3: Development of *Branchiostoma* (*Amphioxus*) up to gastrulation; chick egg and its development up to the formation of primitive streak, Extra embryonic membranes of chick, development of placenta in rabbit, types and functions of placenta in mammals.
- Unit 4: Various types of stem cells and their applications (with special reference to embryonic stem cells), Cloning of animals: nuclear embryonic transfer

technique, nuclear transfer technique; Identical, Siamese and fraternal twins and Artificial insemination.

Unit 5: Organogenesis of alimentary canal, eye, kidney, gonads and brain in mammal.

### **PAPER III**

#### **Immunology, Microbiology and Biotechnology**

Unit 1: Types of immunity (innate and acquired, humoral and cell mediated), Antigen: Antigenicity of molecules, haptens, Antibody: Structure and functions of each class of immunoglobulins (IgG, IgM, IgD, IgA and IgE), antigen - antibody reactions.

Unit 2: Theory of spontaneous generation; Germ theory of fermentation and diseases: Works of Louis Pasteur, John Tyndal, Rober-Koch and Jenner, Bacteria: Cell membrane, patterns of arrangement; structure of capsule and cell envelops; organization of cytoplasmic membrane of Gram - negative and Gram - positive strains, Genetic material of bacteria: (i) Chromosome (ii) Plasmids.

Unit 3: Asexual and sexual reproduction in Bacteria ,Culture of Bacteria: Carbon and energy source, Nitrogen and minerals and Organic growth factors, Effect of environmental factors on bacterial culture: Temperature, hydrogen ion concentration; Medical importance of Gram-negative and Gram-positive bacteria.

Unit 4: Recombinant DNA technology: Introduction and principles, restriction endonucleases, cloning vehicles (plasmids, bacteriophages); methods of gene transfer and applications.

Unit 5: Environmental Biotechnology (outline idea only): Metal and petroleum recovery, pest control, waste-water treatment, Food, Drink and Dairy Biotechnology (outline idea only): Fermented food production: dairy products, alcoholic beverages and vinegar: microbial spoilage and food preservation.

## Practical

1. Study of microbes in food material (like curd, etc.)
2. Bacteria culture
3. DISSECTIONS  
*Scoliodon* : General anatomy, alimentary canal, afferent and efferent blood vessels, urinogenital system, brain and cranial nerves – V, VII, IX and X only and internal ear  
*Labeo / Wallago*, Brain V, VII, IX and X Cranial nerves, afferent and efferent blood vessels, air sacs, and internal ear.  
*Rattus*: General anatomy, digestive, blood vascular and urinogenital systems
4. OSTEOLOGY  
Articulated and disarticulated skeleton of *Rana*, *Varanus*, *Gallus* and *Oryctolagus*
5. PERMANENT PREPARATIONS  
*Scoliodon*: Placoid scales, Ampulla of Lorenzini.
6. Identification, systematic position and comments of the following animals:  
Hemichordata: *Balanoglossus*  
Urochordata: *Salpa*, *Doliolum* and *Herdmania*  
Cephalochordata: *Petromyzon* and *Myxine*  
Pisces: *Zygaena*, *Scoliodon*, *Pristis*, *Torpedo*, *Trygon*, *Protopterus*, *Labeo*, *Heteropneustis* (*Saccobranchus*), *Belone*, *Exocoetus*, *Anabas* and *Echeneis*  
Amphibia: *Necturus*, *Amphiuma*, *Amblystoma*, *Axolotal larva*, *Hyla*, *Uraeotyphlus*  
Reptilia: *Trionyx*, *Chelone*, *Varanus*, *Uromastix*, *Ophiosaurus*, *Naja*, *Bungarus*, *Echis*, *Hydrophis*, *Eryx*, *Ptyas*, *Crocodilus* and *Gavialis*  
Aves: *Columba*, *Pavo*, *Choriotis*, *Francolinus*, *Streptopelia*  
Mammalia: *Meriones*, *Funambulus*, *Rattus*, *Hemiechinus*, *Suncus*, *Ptecopus*, *Presbytis* and *Macaca*
7. Microscopic Study  
Hemichordata: Section through proboscis and branchiogenital region  
*Branch stoma*: T.S. oral hood, pharynx, gonads, intestine and caudal region  
*Scoliodon*: T.S. gill and scroll valve  
*Rana*: T.S. through various organs, T.S. and L.S. of developmental stages  
Reptilia: V.S. skin of lizard  
Aves: V.S. skin, different types of feathers  
Chick embryology: Whole mounts of embryos of 18, 24, 33, 48 and 72 hours  
Mammalia: T.S. through various organs

Note: Each regular student is required to keep a record of practical work done by him/her duly checked by the teacher which will be submitted at the time of practical examination.

### Distribution of Marks

Maximum Marks: 75

Minimum Pass Marks: 27

	<u>Regular</u>	<u>Ex.</u>
Major dissection (one)	15	20
Minor dissection (one)	06	11
Permanent preparation (one)/Study of microbes in food material (like curd, etc.)/Bacteria culture	10	10
Spots (eight)	24	24
Viva-voce	10	10
Practical record	10	---
Total	75	75

### List of Recommended Books

1. Arey, L.B. : Developmental Anatomy, Asia Publishing House, Mumbai
2. Chopra, V.L. : Genetic Engineering and Biotechnology, Oxford & I.B.H., New Delhi
3. Das, S.M. : The Indian Zoological Memoirs, Herdmania, Lucknow Publishing House, Lucknow
4. Jorden, E.L. and Verma, P.S.: Chordate Zoology and Animal Physiology, S. Chand & Co., N. Delhi
5. Kotpal, R.L. : Chordate Zoology, Rastogi Publication, Meerut
6. Dalela, R.C. : A Text Book of Chordate Zoology, Jai Prakash Nath Publication, Meerut
7. Bhatia, A., Jain, N. and Kohli, N.S.: An outline of Biotechnology, Ramesh Book Depot, Jaipur
8. Balinsky : Introduction to Embryology (CBS College Publishers)
9. Kuby : Immunology (W.H. Freeman)
10. R.A. Meyers (Ed.) : Molecular Biology and Biotechnology (VCH Publishers)
11. Jain, P.C. : Text Book of Embryology, Vishal Publication, Jalandhar
12. Srivastava, M.D.L. : An Introduction to Comparative Anatomy of Vertebrates, Pothishala Ltd., Allahabad
13. Thillayampalam, E.M. : Scoliodon, Lucknow Publishing House, Lucknow
14. Weichert, G.K. : Anatomy of the Chordates, McGraw Hill, New York
15. Lewis, C.D. and Lewin, R., Biology of Gene, McGraw Hill, Toppan Co. Ltd.
16. Winchester, Genetics, Oxford IBH Publications
17. Agarwal, R.A., Srivastava, Anil Kumar and Kaushal Kumar: Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi.