

**B.Sc Part-2**  
**Zoology**

Scheme:  
Max. Marks: 100

Min. Marks: 36

Paper I	: 3 Hrs duration	33 Marks
Paper II	: 3 Hrs duration	33 Marks
Paper III	: 3 Hrs duration	34 Marks
Practical	: 4 Hrs duration	50 Marks

**NOTE:**

1. There will be two parts of every theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 (Paper I & II) or 10 (Paper III) very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus. Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, i.e., three from each unit/section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

**PAPER - I: Z-201**

**STRUCTURE AND FUNCTION OF INVERTEBRATE TYPES**

**NOTE**

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**Section-A**

**Structure and Function-I**

Structural and functional organization of vital systems of non-choradates as exemplified by Amoeba, Paramecium, Euglena, Obelia, Sycon, Fasciola, Taenia, Nereis, Hirudinaria, Palaemon, Lamellidens, Pila and Aseterias.

1. Locomotion: Pseudopodial (*Amoeba*), ciliary (*Paramecium*), flagellar (*Euglena*), parapodial (*Nereis*), pedal-muscular foot (*Pila*) and tube-feet (*Asterias*).
2. Skeleton: Endoskeleton (spicules of *Sycon*); exoskeleton, chitinous (*Palaemon*), calcareous (Corals, *Pila*, *Lamellidens* and *Asterias*), siliceous (*Radiolaria*).
3. Nervous System: Sensory and nerve cells (*Obelia*); brain ring and longitudinal nerves (*Fasciola* and *Taenia*); brain and ventral nerve cord (*Nereis* and *Palaemon*); nervous system of *Pila* and *Lamellidens*.



## Section - B

### Structure and Function - II

1. Food feeding, digestive structures and digestion: Autotrophic (Euglena) : heterotrophic through food vacuole ( Paramecium) and in hydroid and medusoid zooids ( Obelia) : Parasitic ( Fasciola, Taenia): Predatory (Palaemon)
2. Respiration: Aquatic general body surface (Euglena): dermal bronchial ( Asterias) parapodia (Nereis), gills ( Palaemon): aerial: pulmonary sac (pila), trachea (insect); anaerobic ( faciola, Taenia).
3. Excretion: General body surface ( protozoa): Protonephridial system and flame cells (Fasciola, Taenia); nephridia ( Nereis, Hirudinaria); malpighian tubules (insect)
4. Circulation: Cyclosis (Euglena, Paramecium); diffusion ( Sycon, Obedia, Fasciola, Taenia); open circulatory system (Palaemon); closed circulatory system ( Nereis).
5. Reproduction: Asexual (paramecium, Euglena, Sycon); alternation of generation (obelia);

### Section- C

#### Invertebrate Adaptations

1. Evolution of canal system of sponges.
2. Social organization in termites and honey bees.
3. Water vascular system of starfish.
4. Crustacean larvae.

## PAPER - II: Z-202

### ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

#### NOTE:

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2. The candidate has to answer all questions in the main answer book only.

### Section-A

#### Animal Physiology with special reference to mammals

1. Osmoregulation in mammals.
2. Physiology of digestion: Various types of digestive enzymes and their digestive action in the alimentary canal.
3. Physiology of blood circulation: Composition and functions of blood; mechanism of blood clotting; body temperature regulation.
4. Physiology of respiration: Mechanism of breathing; exchange of gases: transportation of oxygen and carbon dioxide in blood.
5. Physiology of excretion: Kinds of nitrogenous excretory end products (ammonotelic, uricotelic and ureotelic); role of liver in the formation of these end products. Functional architecture of mammalian kidney tubule and formation of urine.

### Section - B

#### Regulatory aspects of Animal Physiology

1. Physiology of nerve impulse and reflex action: functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission.
2. Physiology of muscle contraction: Functional architecture of skeletal muscles; chemical and biophysical events during contraction and relation of muscle fibers.
3. Types of endocrine glands, their secretions and function Pituitary, adrenal, thyroid, islets of Langerhan's, testis and ovary.



4. Physiology of Reproduction: Hormonal control of male and female reproduction.
5. Hypothalamic Control of pituitary function.

### Section-C

#### Biochemistry

1. Carbohydrates: Structure, function and significance: oxidation of glucose through glycolysis, Krebs' cycle and oxidative phosphorylation; role of insulin and glucagon.
2. Proteins : Structure, function and significance, essential and non-essential amino acids, transformation of amino acids: deamination, transamination, decarboxylation. Synthesis of protein and urea, fate of ammonia (Ornithine cycle).
3. Enzymes: Types and mechanism of action.
4. Lipids: Structure, function and significance; Beta-oxidative pathway of fatty acids; brief account of biosynthesis of triglycerides.

### Paper - III: Z-203

### Immunology, Microbiology & Biotechnology

#### NOTE:

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2. The candidate has to answer all questions in the main answer book only.

#### Section - A

#### Immunology

1. Immunology: Definition, types of immunity: innate and acquired; humoral and cell mediated. Organs of immune system.
2. Antigen and antibody: Antigenicity of molecules, happens, antibody types.
3. Antigen-Antibody reactions; Precipitation reaction, agglutination reaction, neutralizing reaction, complement and lytic reactions and phagocytosis.
4. Immunity Regulating Cells: Macrophages, lymphocytes (B and T-Types) T-helper cells, T-Killer cells, plasma cells and memory cells.
5. Mechanism of humoral or antibody mediated immunity and cell mediated immunity.

#### Section- B


#### Microbiology

1. Brief introduction to the History of Microbiology: Work of Antony Van Leeuwenhoek, theory of spontaneous generation, germ theory of fermentation and disease: Works of Louis Pasteur, John Tyndall, Robert Koch and Edward Jenner.
2. The Prokaryota (Bacteria) : Structural organization:
  - (i) Size, shapes and patterns of arrangement
  - (ii) Structural organization: Slime layer (capsule), cell envelopes: cytoplasmic membrane (inner membrane). Cell wall (outer membrane) of Gram-negative and Gram-positive bacteria; Mesosomes; cytoplasmic organization; cell projections: flagella and cilia.
3. Bacteria of Medical Importance:



- (i) Gram-Positive  
a. Cocci: *Staphylococci*, *Streptococci*  
b. Bacilli: *Diphtheria*, *Tetanus*.
- (ii) Gram-Negative  
a. Cocci: *Gonorrhoea*, *Meningitis*  
b. Bacilli: *Diarrhoea*
- (iii) Mycobacteria: *Tuberculosis*, *Leprosy*
4. AIDS and hepatitis. The causative agents, transmission, pathogenicity, laboratory diagnosis, treatment and prevention (elementary idea only).

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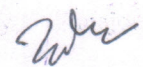


Section - C

**Biotechnology**

1. Definition, history, scope and application of biotechnology, major areas of biotechnology (microbial, plant and animal biotechnology).
2. Vectors for gene transfer.
3. Basic concepts of animal cell, tissue, organ and embryo culture.
4. Protoplast fusion in prokaryotes and eukaryotes.
5. Recombinant DNA technology; hybridomas and their applications, PCR, DNA finger printing, DNA foot printing, RFLP, RAPD & AFLP, Human genome project, Genomics & Proteomics (Brief idea only).
6. Monoclonal antibodies and their applications.
7. Genetic engineering (outline idea only); Applications of genetic engineering, hazards and regulations.
8. Transgenic animals, their uses.
9. Brief account of cloning: its advantages and disadvantages.

On: \_\_\_\_\_  
2020-21

  
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**Syllabus: B.Sc. Part - II (Pass Course)**  
**Zoology Practical**  
**(2016-2017)**

**Min. Marks: 18**

**4 Hrs./ Week**

**Max. Marks: 50**

**I. Study of Museum Specimens:**

Annelida	: Neanthes, Heteronereis, Aphrodite, Chaetopterus, Arenicola, Glossiphonia, Pontobdella, Polygordins.
Onychophora	: Peripatus
Arthropoda	: <i>Limulus</i> , Spider, Scorpion, Centipede, Millipede, Lepas, Balanus, Squilla, Eupagurus, Crab, <i>Mantis</i> , Honey-bee, (queen, king, worker) Locust, Silkworm Moth, Beetle, White grub.
Mollusca	: Chiton, Aplysia, Cypraea, Mytilus, Pearl Oyster, Dentalium, Loligo, Nautilus.
Echinodermata	: Pentaceros, Echinus, Ophiothrix, Cucumaria, Antedon.
Hemichordata	: Balanoglossus

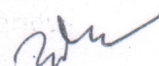
**II. Study of Microscopic Slides:**

Annelida	: T.S. body of Nereis through various regions.
Arthropoda	: V.S. of integument (cuticle): Pediculus, Bedbug, Termite and its castes, Cyclops. Daphnia, crustacean larvae ( Nauplius, Zoea, Mysis, Megalopa). Statocyst of prawn.
Mollusca	: V.S.Shell. T.S gill of pila: Glochidium larva

**III. Study of the Following Through Permanent Slide Preparation:**

- (i) Trachea, Mosquito larva, Lice, Termites.
- (ii) Differential staining and identification of various types of blood cells. \ 0

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#### IV. Anatomy:

Prawn/Squilla

:Study of External features, appendages, alimentary canal and nervous system; Hastate Plate

Cockroach/Grasshopper

: Study of External features, Appendages, Alimentary canal, Nervous system and Mouthparts.

#### V. Microbiology Immunology and Biotechnology:

1. Preparation and use of culture media for microbes.
2. Study of microbes in food materials like curd, etc (Lactobacillus Aspergillums, Mucor, Penicillium.
3. Educational tour to any Microbiology Laboratory, Dairy, Food processing factory and Distillery for first hand study. Collection of material may also be encouraged wherever possible. Candidates are expected to submit a detailed report of such visit.
4. Antigen-antibody reactions-precipitation, agglutination
5. A brief practical idea of fermentation of food, food preservation.

#### VI. Animal Physiology:

1. Counting of red and white blood cells in the given blood sample.
2. Estimation of hemoglobin in the given blood sample.
3. Estimation of haematocrit value (PCV) in the given blood sample.
4. Demonstration of enzyme activity (catalase) in liver.
5. Study of salivary digestion of starch and the effect of heat and alcohol on salivary digestion of starch.
6. Study of histological structure of major endocrine glands of mammals.
7. Demonstration of blind spot in Human-eye.

#### VII. Biochemistry:

1. Detection of protein, carbohydrate and lipid in the animal tissue/food samples.
2. Identification of different kinds of mono-di-and polysaccharides in the given food samples
3. Circular paper chromatography of dyes/amino acids.

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**B.Sc. Part - II**  
**Scheme of Practical Examination Distribution of Marks**

Time: 4 Hrs.

Min. Pass Marks : 18

Max. Marks: 50

	Regular	Ex./N.C. Students
1. Anatomy (any system)	3	3
2. Permanent Preparation Exercise in	4	6
3. Microbiology/ Immunology /Biotechnology	5	6
4. Exercise in Animal Physiology	6	7
5. Exercise in Biochemistry	6	7
6. Identification and comments on Spots (1 to 8)	16	16
7. Viva voce	5	5
8. Class Record	5	-
	<b>50</b>	<b>50</b>

**Notes:**

1. With reference to Anatomy, study of prescribed types (charts/models) candidates must be well versed in the study of various systems. CD ROMs, multimedia computer based simulations including computer assisted learning (CAL) and other soft wares may be used.
2. With reference to permanent preparations and microscopic slides, the exercise should be substituted with diagrams, photographs, models, charts, etc.
3. Candidates must keep a record of all work done in the practical class and submit the same for inspection at the time of the practical examination.
4. The candidates may be asked to write detailed methodology wherever necessary and separate marks may be allocated for the same.
5. Mounting material for permanent preparations would be as per the syllabus or as available through collection and culture methods.
6. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently or Necessary permission from chief wildlife warden be sought.

**Recommended Books:**

1. Barnes R. D: Invertebrate Zoology, W. B. Saunders, 1969.
2. Barrington EJW: Invertebrate Structure and Function. 2nd edition John Wiley & Sons, Inc., 1978.
3. Barrington EJW: The Biology of Hemichordata and Protochordata. Oliver & Boyd, London 1965.
4. Barrett KE, Barman SM, Boctano, S and Brooks HL. Ganongs: Review of Medical Physiology. 24th edition Me Graw Hill Education India Pvt. Ltd., 2012.
5. Berril NJ: The Tunicates. The Roy Society, London.
6. Brusca RG and Brusca GJ: Invertebrates. 2nd edition Sinauer/Panama Books, 2003.
7. Cooper GM and Hausman RE: The Cell: A Molecular Approach. 6th edition ASM Press Washington, DCI Sinauer/Panama Books, 2013.
8. Conn EE, Stumpf PK, Bruening G, Doi, RH: Outline of Biochemistry. 5th edition. John Wiley & Sons, 1987.
9. De Robertis EDP' and De Robertis Jr EMF: Cell and Molecular Biology. 8th edition Lippincot Williams & Wilkins, 2006.
10. David R, Burggren Wand French K: Eckert Animal Physiology. 5th edition W H

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- Freeman & Company, New York, 2001.
11. Eckert R, Randall D. J. Burggen W, French K: Eckert Animal Physiology and Burggren WW & Co. Ltd., 1997.
  12. Fox SI: Human Physiology. 8th edition McGraw Hill Education 2003.
  13. Gardner EL, Simmons MJ and Snustad DP: Principles of Genetics 8th edition John Wiley & Sons, Inc., 2006.
  14. Giese A. C: Cell Physiology. 4th Edition, Saunders, 1973.
  15. Glick BR., Paeternak 11: Molecular Biotechnology, 4th edition ASM Press, 2010.
  16. Goldsby RA, Kindt TJ and Osborne BA: Kuby Immunology. WH Freeman and Co., New York, 2002.
  17. Grant: Biology of Developmental System
  18. Gupta PK. Genetics: Classical to Modern. Rastogi Publications, 2007.
  19. Hall JE: Guyton and Hall Textbook of Medical Physiology. 12th edition Saunders Publications, 2010.
  20. Hill RW, Wyse GA, Anderson M: Animal Physiology. 3rd edition Sinauer Associates Inc. USA, 2012.
  21. Hyman LH: The Invertebrates, Vol. 6, Mc Graw Hill.
  22. Jordan EL and Verma PS: Invertebrate Zoology. S. Chand & Company Ltd., 2012.
  23. Karp G: Cell & Molecular Biology: Concepts and Experiments. 7th edition John Wiley & Sons, Inc., 2013.
  24. Kotpal RL: Modern Text Book of Zoology: Invertebrates. Rastogi Publications, 2012.
  25. Lal SS: Practical Zoology Invertebrate. 11th revised edition Rastogi Publications, 2014.
  26. Lehninger AL: Biochemistry. 2nd edition Kalyani Publishers, 1991.
  27. Lal SS: Practical Zoology Invertebrate. 11th revised edition, Rastogi Publications, 2014.
  28. Lehninger AL: Biochemistry. Kalyani Publisher, 2008.
  29. Lodish H, Berk A, Kaiser CA, Krieger M, Bertscher A, Ploegh H, Amon A, Scott M P. Molecular Cell Biology. 7th edition. Mac Millian High Education (International edition) England, 2013.
  30. Meyers R. A: Molecular Biology and Biotechnology (A comprehensive Desk References John Wiley & Sons, 1995.
  31. Murphy K: Janeway's Immunology. Garland Science: 11th edition, 2011.
  32. Nelson DL and Cox MM: Lehninger Principles of Biochemistry. 5th edition W. H. Freeman, 2008.
  33. Nelson DL and Cox MM: Lehninger Principles of Biochemistry. 6th edition W. H. Freeman, 2013.
  34. Owen J, Punt J, Stranford S: Kuby Immunology. 7th edition WH Freeman & Co. Ltd., 2013.
  35. Old RW and Primrose SB: Principles of Gene Manipulation: An Introduction to Genetic Engineering. University of California, 1980.
  36. Sastry KV: Animal Physiology and Biochemistry, 2nd edition Rastogi Publications, 2014-15.
  37. Vander AJ, Sheerman J, Liciano D: Human Physiology: The Mechanics of Body Function. Mc Graw Hill Co., New York, 1998.
  38. Verma PS and Jordan EL: Invertebrate Zoology. S. Chand & Co. Ltd, New Delhi, 2001.
  39. Verma PS, Tyagi BS, Agarwal VK: Animal Physiology. 6th edition S. Chand & Co., 2004.
  40. Voet D and Voet JG: Biochemistry. 4th edition, John Wiley & Sons, Inc., 2011.
  41. Voet D and Voet JG: Biochemistry. John Wiley & Sons, New York, 1990.
  42. Verma PS: A Manual of Practical Zoology: Invertebrates. S. Chand & Co. Ltd. New Delhi, 1971.
  43. Voet D and Voet JG: Biochemistry. 4th edition, John Wiley & Sons Inc., 2011.
  44. Wake MH: Hyman's Comparative Vertebrate Anatomy. 3rd edition University of Chicago Press Ltd. London, 1992.



45. Trigunayat, M.M : A Manual of Practical Entomology. Scientific Publisher, Jodhpur (Raj.)  
46. Trigunayat, M.M and Kritika Trigunayat: Prayogic Manual Part-2 Scientific publishers,  
Jodhpur, Rajasthan.

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