



Maharaja Surajmal Brij University
Bharatpur (Rajasthan)
Syllabus for Zoology
Under Graduate Programme
V to VI Semester
Academic Session (2025-26)

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उप कुलसचिव
महाराजा सुरजमल बृज विश्वविद्यालय
भारतपुर (राज.)

Syllabus

ZOO-20T-501 - Animal Physiology & Biochemistry

Practicals based on Animal Physiology & Biochemistry

V Semester - Zoology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	ZOO-20T-501	Animal Physiology & Biochemistry Practicals based on Animal Physiology & Biochemistry			7	6
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method
		Theory	Practical	Total		
7	MJR	4	2	6	Yes	Lectures: 60 lectures, including diagnostic and informative assessments during lecture hours and 30 hours of Practical training/ Demonstration.
List of Programme Codes in which Offered as Minor Discipline		B.Sc. Chemistry B.Sc. Botany				
Prerequisites		IV Semester (B. Sc. Biology group)				
Objectives of the Course:		<p>The learning objectives of this course are as follows:</p> <ul style="list-style-type: none"> To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals, To expand their knowledge with respect to functioning of various organ systems 				

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वाराणसी (उत्तर)

ZOO-20T-501 - Detailed Syllabus
V Semester - Animal Physiology & Biochemistry

Unit - I

Physiology of digestion: Definition of digestion; various types of digestive enzymes and their digestive action in the, alimentary canal; absorption and assimilation of carbohydrates, proteins, and lipids.

5

Hrs

Physiology of respiration: Definition of respiration; mechanism of breathing; exchange of gases; transportation of oxygen and carbon dioxide in blood; regulation of respiration; respiratory pigments.

5 Hrs

Physiology of blood circulation: Composition and functions of blood; mechanism of blood clotting; heartbeat; cardiac cycle; blood pressure; regulation of body temperature.

5 Hrs

Unit - II

Physiology of excretion: Kinds of nitrogenous excretory end products; functional architecture of nephron; mechanism of urine formation; hormonal regulation of water and electrolyte balance (Homeostasis).

7 Hrs

Physiology of nerve impulse: Functional architecture of a neuron; origin and propagation of nerve impulse; synaptic transmission; reflex arc.

4 Hrs

Physiology of muscle contraction: Functional architecture of skeletal muscles; chemical and biophysical events during contraction and relaxation of muscle fibers.

4 Hrs

Unit - III

Physiology of reproduction: Control and regulation of testis and ovarian functions; female reproductive cycles; implantation, parturition and lactation in mammals. Testes and Ovary.

6 Hrs

Physiology of endocrine glands: Types of endocrine glands, their secretions and functions - pituitary, adrenal, thyroid and pancreas.

6 Hrs

Hormonal regulation: Mechanism of hormone action; feedback mechanism; hypothalamic control of pituitary function.

3 Hrs

Unit - IV

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Carbohydrates: Structure, classification, and functions of carbohydrates; glycolysis; Krebs cycle; oxidative phosphorylation and gluconeogenesis. 6

Hrs

Proteins: Structure, classification, and functions of proteins; deamination; transamination; decarboxylation; ornithine cycle; enzymes- definition, classification, inhibition, and regulation. 5 Hrs

Lipids: Structure, classification, and functions of lipids; β -oxidation; brief account of biosynthesis of triglycerides. 4 Hrs

Suggested Books and References —

1. *A Textbook of Medical Physiology* (2017) - Arthur C. Guyton, 11th Ed., Harcourt Asia Ltd.
2. *Animal Physiology* - Roger Eckert & Randall, 4th Ed., Freeman & Co., New York.
3. *Textbook of Animal Physiology* — Veer Bala Rastogi, Kedarnath Ramnath, Meerut.
4. *Animal Physiology* — Eckert R., Randall D.J., Burggren W., French K., 1997, W.H. Freeman & Co. Ltd.
5. *Practical Zoology* — Lai S.S. (2014), Rastogi Publications.
6. *Lehninger Principles of Biochemistry* — Nelson D.L. & Cox M.M. (2013), 6th Ed., W.H. Freeman.
7. *Animal Physiology and Biochemistry* — Sastry K.V., 2nd Ed., Rastogi Publications.
8. *Animal Physiology* — Verma P.S., Tyagi B.S., Agarwal V.K. (2004), 6th Ed., S. Chand & Co.
9. *Biochemistry of Biomolecules* — Ritu Kamal (2006), Paragon International Publishers.
10. *Biochemistry* — Voet D. & Voet J.G. (2011), 4th Ed., John Wiley & Sons, Inc.
11. *Concepts of Biochemistry* — Gupta S.N., Rastogi Publications, Meerut.
12. *Zoology for Degree Students* — Agarwal V.K., S. Chand & Co., New Delhi.
13. *Principles of Anatomy and Physiology* — Tortora G.J. & Derrickson B.H. (2009), 12th Ed., John Wiley & Sons, Inc.
14. *Animal Physiology: Mechanisms and Adaptations* — Eckert R., W.H. Freeman & Co.

Suggested E-Resources:

1. National Institute of Science Communication & Information Resources (NISCAIR):
<https://niscpr.res.in>
2. National Digital Library of India (NDL India):
<https://ndl.iitkgp.ac.in>
3. SWAYAM Online Courses:
<https://onlinecourses.swayam2.ac.in>
4. NPTEL (Animal Physiology):
https://onlinecourses.nptel.ac.in/noc20_bt42/preview
5. Virtual Labs:
<https://www.vlab.co.in>
6. IGNOU Study Material (Animal Physiology - English/Hindi):
<https://www.ignouhelp.in/ignou-lsc-05-study-material>

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7. Rastogi Publications Catalogue: <https://rastogipublications.com>
8. Allied Publishers - Zoology for Degree Students: <https://www.alliedpublishers.com>
9. A.K. Jain - *Physiology Practical Manual*: <https://www.scribd.com/document/696830782/A-K-Jain-Physiology-Practical-Manual>

Course Learning Outcomes:

By studying this course, students will be able to:

- Have an enhanced knowledge and appreciation of animal physiology.
- Recognize and identify principal tissue structures and their functions.
- Better understand the functions of important physiological systems, including the nervous system, muscular system, endocrine system, and reproductive system.
- Understand how these separate systems interact to yield integrated physiological responses to maintain homeostasis in the body, along with feedback mechanisms.
- Develop a strong foundation for research and employability skills using the knowledge of biochemistry.
- Improve their perspective of health through deep study of physiology and biochemistry.

Practical Syllabus

UG0802-ZOO-75P-302-Practicals Based on Animal Physiology & Biochemistry

1. Counting of **RBCs** and **WBCs** using a **haemocytometer**.
2. Estimation of **haemoglobin** by **Sahli's haemometer**.
3. Estimation of **haematocrit value (PCV)** and **ESR**.
4. Preparation of **blood smear** to study different blood cell types using **Wright's or Leishman stain**.
5. Demonstration of **enzyme activity (catalase)** in the liver.
6. Study of the effect of **pH and temperature** on **salivary amylase activity**.
7. Study of **histological sections** of various organs and major endocrine glands: Stomach, Intestine, Lungs, Spleen, Liver, Kidney, Spinal cord, Pituitary, Parathyroid, Thyroid, Pancreas, Adrenal gland, Testis and Ovary
8. Detection of **proteins** in animal tissue/food samples.
9. **Detection of carbohydrates** in the animal tissue/food samples.

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10. **Detection of lipids** in the animal tissue/food samples.
11. Demonstration of separation of **amino acids** from a mixture using **Paper chromatography**.

Scheme of Practical Examination and Distribution of Marks

S.No.	Practical Exercises	Regular Students	Ex. /NC. Students
1	Major exercise (Physiology)	6	12
2	Minor exercise (Physiology)	4	6
3	Minor exercise (Biochemistry)	4	6
4	Identification and comments on Spots (1 to 8)	16	16
5	Viva Voce	5	10
6.	Class Record and report	5	-
		10*+ 40 =50	50

Note:

*Internal marks for regular students only.

1. With reference to microscopic slides, in case of non-availability, the exercise should be substituted with diagrams / photographs
2. 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.
3. Mounting material for permanent preparations would be as per the syllabus or as available through collection and culture methods.

Objectives of the Course	<ul style="list-style-type: none"> • The objectives of studying a combined course in Microbiology, Immunology and Biostatistics are to develop a foundational understanding of microorganisms, the immune system and statistical methods. • Students will acquire practical skills in microbiological and immunological techniques, including culturing, staining, and identifying microbes, as well as conducting immunoassays.
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	<ul style="list-style-type: none"> • The course aims to help students understand the interplay between microbiology, immunology, and biostatistics, applying statistical analysis to interpret experimental data in these fields. • It enhances abilities in designing experiments, collecting and analyzing data, and drawing valid conclusions, thereby fostering research capabilities. • The course prepares students for careers in biomedical research, clinical diagnostics, public health and related fields by understanding the applications of these disciplines in health and disease.
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VI Semester

ZOO-20T-601: Microbiology, Immunology & Biotechnology Detailed Syllabus

History of Microbiology: Contributions of Anton van Leeuwenhoek, Louis Pasteur, Edward Jenner, and Robert Koch. 2

Hrs

Basic Structural and functional characteristics of bacteria, fungus, cyanobacteria, rickettsiae, chlamydia, mycoplasmas and virus. Structural organization of bacteria: Capsule, Cell wall, Cell membrane, Cytoplasm, Chromosome, Growth phases

4 Hrs

Techniques in Microbiology: Pure culture technique, growth conditions (temperature, pH, nutrients), Gram's staining. 3 Hrs

Bacterial Diseases: Causative agent, brief pathology, treatment, and prevention of the Diphtheria, meningitis, tuberculosis, botulism, tetanus, Leprosy. 3 Hrs

Viral Diseases: Causative agent, brief pathology, treatment and prevention of Influenza, Herpes, Measles, Chickenpox, Smallpox, Rabies, Polio, AIDS, COVID-19. 3 Hrs

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Unit II

Components of Immune System: Different types of cells and organs involved. **3 Hrs**

Antigens: Essential features of antigens, antigenic determinants, immunological valence, adjuvants, haptens. **2 Hrs**

Antibodies: Nature and primary structure of immunoglobulins; types of immunoglobulins IgG, IgM, IgA, IgD and IgE and their structure and functions. **2 Hrs**

Antigen-Antibody Reactions: Precipitation and agglutination. **2 Hrs**

Types of Immunity: Active and passive immunity, cell-mediated immunity, humoral immunity, autoimmunity. **3 Hrs**

Basic idea of Interferons, complement system and MHC. **3 Hrs**

Unit III

Application of Microbes: Use of microbes in fermented foods, dairy, and beverages: wine, beer, cheese, curd and vinegar. **5 Hrs**

Use of microbes in wastewater treatment and bioremediation (brief idea). **4 Hrs**

Types of Vaccines: Live attenuated, inactivated vaccines, DNA and recombinant vaccines. **3 Hrs**

Monoclonal Antibodies: Production and applications of monoclonal antibodies; Abzymes. **3 Hrs**

Unit IV

Concept and Scope of Animal Biotechnology: Cloning methods (Cell, animal, and gene cloning). Vectors – plasmids, cosmids, lambda bacteriophages and yeast artificial

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chromosomes (YAC). 4

Hrs

Animal Cell Culture: Equipment and materials for animal cell culture; applications of cell culture techniques. Recombinant DNA technology and its applications. 4 Hrs

Transgenesis: Methods of transgenesis, production of transgenic animals and their applications in biotechnology. Stem cells – types and their applications. 4 Hrs

Dairy Biotechnology: Overview of food, drinks and dairy biotechnology (Outline idea only). Fermented food production – dairy products, wine, beer, vinegar and food preservation. 3

Hrs

Suggested Books and References

1. *Fundamentals of Microbiology* by Edward Alcamo. Benjamin/Cummings Publishing Company, Inc.
2. *Prescott's Microbiology* by Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton, 2017, McGraw-Hill.
3. Kindt, T.J., Goldsby, R.A., Osborne, B.A., & Kuby, J. (2007). *Kuby Immunology* (6th ed.). New York: W.H. Freeman and Company.
4. Owen, J.A., Punt, J., Stranford, S.A., & Jones, P.P. (2018). *Kuby Immunology* (8th ed.). New York: W.H. Freeman and Company.
5. Abbas, A.K., Lichtman, A.H. (2001). *Basic Immunology: Functions and Disorders of the Immune System*. U.S.: W.B. Saunders.
6. *Biotechnology* by U. Satyanarayana (2010).
7. B.D. Singh (2004). *Biotechnology: Expanding Horizons*. Kalyani Publishers, New Delhi, India.
8. Pelczar, M.J., Chan, E.C.S., & Krieg, N.R. (2003). *Microbiology: Concepts and Applications*. McGraw-Hill Education.
9. Delves, P.J., Martin, S.J., Burton, D.R., & Roitt, I.M. (2011). *Roitt's Essential Immunology* (12th ed.). New Jersey, USA: John Wiley & Sons Ltd.
10. Primrose, S.B. *Principles of Gene Manipulation and Genomics*.

Suggested E-Resources



1. **Microbiology Society:** Offers educational resources, including articles and learning materials for microbiology.
2. **OpenStax – Microbiology Textbook:** A free, peer-reviewed textbook covering a wide range of topics in microbiology.
3. **Microbe Wiki:** A student-edited resource providing detailed information on various microorganisms.
4. **Immunology Online Textbook:** A comprehensive online textbook by NCBI covering various aspects of immunology.
5. **Janeway's Immunobiology:** A widely respected textbook available online offering in-depth coverage of immunology.

Course Learning Outcomes:

After successful completion of the course, students will be able to:

- Understand the basic concepts of Microbiology, Immunology and Biotechnology.
- Explain the role of microbes and the functions of microorganisms.
- Describe the role of microbes in the environment, industry and human health.
- Explain the principles and applications of immunological techniques.

ZOO-20P-602: Practical Syllabus

Practicals based on Microbiology, Immunology and Biotechnology:

Microbiology:

1. Preparation and use of culture media for microbes (NA and PDA).
2. Culture of microbes (bacteria and fungi) from food (curd/ spoiled food).
3. Gram's staining for bacteria.
4. Simple staining of bacteria.

Immunology

5. Tests of Blood Grouping
6. Widal Test to identify any pathogen in blood

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7. Differential Leukocyte Count (DLC) in blood sample.

Biotechnology

1. Study of Lab instruction: Centrifuge, Autoclave, pH meter.
2. Isolation of DNA from cheek cells.
3. Preparation of Agarose gel electrophoresis.
4. Separation of DNA by Agarose gel electrophoresis.
5. Chromatography: Paper/TLC chromatography for separation of dyes/Amino acids.

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Note:

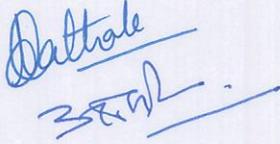
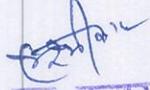
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