

**Hindi Vidya Prachar Samiti's Ramniranjan Jhunjhunwala College of Arts, Science & Commerce
(Empowered Autonomous College)
M.Sc. Part I NEP Zoology Syllabus Semester -I &II**



**Hindi Vidya Prachar Samiti's
Ramniranjan Jhunjhunwala College
of Arts, Science & Commerce
(Empowered Autonomous College)**

**Affiliated to
UNIVERSITY OF MUMBAI**

**M.Sc. Part I Zoology Syllabus Semester -I &II
(under NEP)**

PROGRAM: M.Sc. ZOOLOGY

PROGRAM CODE: RJSPGZOO

**(REVISED in 2026-27 in alignment with the NEP 2020 facilitating the inter-and
multidisciplinary learning and multiple entry and exit of the students)**

(CBCS 2026-2027)

*Final -
10-9-26*



[Signature]

SEMESTER I
DSE-I : ANIMAL PHYSIOLOGY-I

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SEMESTER I	HRS	Credits
PAPER I: <u>Comprehensive Animal Physiology</u> Course Code: RJSPGZOOE101	30	2
UNIT I: PHYSIOLOGY OF NUTRITION AND EXCRETION	15	
1.1 Nature and Acquisition of nutrients-Essential and Non-Essential nutrients, role of symbionts. 1.2 Comparative biochemistry of digestion in vertebrates, Neural and hormonal regulation of secretion of digestive enzymes 1.3. Nutrigenomics: Introduction and application 1.4 Regulation of nutritional intake- Hunger drive, Glucostatic and Hepatostatic theories of hunger drive. *Case study Anorexia Nervosa 1.5 Intracellular and extracellular fluids: Composition and Intracellular regulation. 1.6 Integrated functioning for nitrogen excretion and osmoregulation- contractile vacuole, flame cells, green gland, Malpighian tubules, coelomoducts, nephridia in invertebrates. 1.7 Comparative physiology of vertebrate kidney (Pisces, amphibians, reptiles, birds and mammals) 1.8 Ammonotely, ureotely, purinotely, uricotely, storage excretion : their biochemical basis, physiological significance, adaptive advantages, and examples in different animal groups 1.9 Ammonia Toxicity in fish. *Case studies: Kidney stones and kidney transplants in humans. Haemodialysis and peritoneal dialysis- a human perspective		
UNIT II: PHYSIOLOGY OF NEURONAL SYSTEM	15	
2.1 Integrative Neurophysiology- neurons, interneurons, neural circuits, networks, primitive nervous systems, nerve nets, central pattern generators in invertebrates, chordate nervous system. 2.2. Membranes Potential- action potential, resting membrane potential, ions as current carriers - protons, calcium, potassium, structure of cation-permeable channels and chloride channels. 2.3 Neurotransmitters- types, neurotransmission: synaptic and electrical transmission, * Case Study : Alzheimer w.r.t neuroimmunology & treatment * Case Study : Neurotoxins: Organophosphate pesticides 2.4 Sensory Physiology: General properties of sensory reception and Classification of sensory receptors. 2.5 Types of Reception: Chemoreception, Mechanoreception, Electoreception, Thermoreception, Photoreception 2.6 Physiological Effectors: Cnidoblasts, Bioluminescent systems, Chromatophores, Electric organs.		

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M.Sc-I	Semester I DISCIPLINE SPECIFIC ELECTIVE I
RJSPGZOOE101 COMPREHENSIVE ANIMAL PHYSIOLOGY	Course Objectives: 1. To explain nutrient acquisition, digestion, and the regulation of nutritional intake in animals. 2. To describe nutrigenomics and its role in nutrition, health, and disease. 3. To compare osmoregulatory and excretory mechanisms in invertebrates and vertebrates. 4. To understand the organization and functioning of nervous systems, neural communication, sensory reception, and physiological effectors in animals. 5. To analyse the roles of ion channels, neurotransmitters, sensory mechanisms, neurotoxins, and neurological disorders such as Alzheimer's disease. Learning Outcomes: The learner will be able to: 1. Classify nutrients and explain digestive and nutritional physiology in animals. 2. Comprehend the mechanisms regulating feeding behaviour and metabolic homeostasis. 3. Compare excretory and osmoregulatory adaptations across animal groups. 4. Assess kidney-related disorders and modern therapeutic approaches such as dialysis and transplantation. 5. Explain the mechanisms of neural integration, neurotransmission, and sensory perception across different animal groups. 6. Evaluate the significance of specialized physiological effectors and assess the impact of neurotoxins and neurological disorders on nervous system function 7. The case studies will help the learner to understand, evaluate and apply the knowledge gained

SEMESTER -I PRACTICAL: COMPREHENSIVE ANIMAL PHYSIOLOGY
CODE: RJSPGZOOEP101

1. Study of effect of various factors like pH, temperature, activator, inhibitor on salivary amylase.
2. Study the effect of substrate concentration on the K_m of salivary amylase
3. Determination of Urea, Uric acid, Creatinine in serum/ blood/ urine.
4. Assessment of the effects of sub-lethal ammonia concentration on a suitable fish species exposed to ammonia stress for 3/5/7 days, focusing on the following parameters:
 - i. Level of excretory ammonia.
 - ii. Level of activity of hepatic and brain glutamate dehydrogenase.
 - iii. Level of amino acid content of muscle, gill, brain and liver.
5. Identification of sensory receptors.
(photoreceptors, chemoreceptors:-olfactory receptors, gustatory receptors, carotid body; mechanoreceptors, thermoreceptors, electroreceptors, magnetoreceptors)
6. To demonstrate sensory adaptation by measuring the time taken for loss of perception of a constant light pressure stimulus on the skin.

M.Sc-I	Semester I DISCIPLINE SPECIFIC ELECTIVE I
RJSPGZOOEP101 COMPREHENSIVE ANIMAL PHYSIOLOGY	Course Objectives: The learners will acquire the skill to perform and interpret experiments on enzyme kinetics, biochemical estimations, and physiological responses to ammonia stress. Learning Outcomes: 1. Learners will be able to design experiments. 2. Learner will acquire the practical skills and analytical skill

SEMESTER II

DSE-II : ANIMAL PHYSIOLOGY-II

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SEMESTER II	HRS	Credits
PAPER I: ENVIRONMENTAL & APPLIED PHYSIOLOGY Course Code: RJSPGZOOE201	30	2
UNIT I: ENVIRONMENTAL STRESS AND BIOCHEMICAL ADAPTATION	15	
1.1 Environmental Stress and Stressors. 1.2 Response to Stress- Plasticity: Phenotypic, Developmental and Transgenerational. 1.3 Strategies of Biochemical adaptation to stress 1.4 Osmotic Stress- preservation of solvent capacity, molecular crowding, enzymes, proteins and nucleic acids under osmotic stress. * Case study: Halophiles 1.5 Oxygen: Oxygen debt in vertebrate muscle, Adaptations of vertebrates during prolonged diving, Decompression sickness in humans. 1.6 Temperature: Biochemical adaptations of Ectothermy- antifreeze substances, heat shock proteins, LDH as a model enzyme for temperature adaptation, Endothermy and Homeothermy in Insects *Case Study: Hypoxia in Humans, Adaptation of population in Tibet, Andes and Ecuador.		
UNIT II: ANIMAL MODELS AND DIAGNOSTIC APPROACHES IN ANIMAL PHYSIOLOGY	15	
2.1 Introduction to Animal Models: <i>Drosophila</i> , <i>Caenorhabditis elegans</i> , Zebrafish, Mouse. Induced and spontaneous, knockout (transgenic) Animal Models 2.2 Alternatives to animal models- <i>in silico</i> systems, <i>in vitro</i> systems *Animal Ethics- CPCSEA guidelines for Animal Experiments 2.3 PCR based diagnostics for detection of infectious diseases. 2.4 Immunoprecipitation- types and application 2.5 Scanning Techniques- PET Scan, CT, MRI (Introduction and application). 2.6 Application of Proteomics in diagnosis of diseases		

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M.Sc-I	Semester II DISCIPLINE SPECIFIC ELECTIVE I
RJSPGZOOE201 ENVIRONMENTAL & APPLIED PHYSIOLOGY	Course Objectives: 1. To understand the mechanism of stress induced responses in animals. 2. To understand the biochemical adaptation to stress. 3. To understand the working and application of techniques used for diagnosis. 4. To introduce the learner various animal models. 5. To introduce the learner to Animal ethics and governing bodies in animal experimentation. Learning Outcomes: 1. The learner will understand the effect of environmental factors on gene expression. 2. The learner will appreciate different techniques used in diagnostics. 3. The learner will understand the use of different animal models, alternatives for animals experimentation and the ethics for animal research

**SEMESTER -II PRACTICAL:
ENVIRONMENTAL & APPLIED PHYSIOLOGY**

CODE: RJSPGZOOEP201

1. To study the effect of decreasing partial oxygen pressure of water on the respiratory rate of a fish and accumulation of lactic acid in muscle.
2. To determine the effect of osmotic stress on the fish.
3. Effect of different salt concentrations on the diameter of RBC.
4. Evaluation of the Ouchterlony technique for demonstrating immunodiffusion.
5. Demonstration of single radial immunodiffusion of antibody and antigen.
6. ELISA: Demonstration of technique
7. To culture and maintain *Drosophila melanogaster*. To study the exposure of UV radiation on development of *Drosophila*.

M.Sc-I	Semester II DISCIPLINE SPECIFIC ELECTIVE I
RJSPGZOOEP201 ENVIRONMENTAL & APPLIED PHYSIOLOGY	Course Objectives: 1. To develop practical skills in studying physiological responses to oxygen depletion, osmotic stress, immune reactions, and environmental stressors using laboratory organisms. 2. To apply experimental techniques to analyse respiratory, osmoregulatory, immunological, and developmental responses in animals. The learner will be able to: 1. Perform and interpret experiments related to hypoxia, osmoregulation, immunodiffusion, ELISA, and physiological adaptations to environmental stress. 2. Demonstrate proficiency in handling model organisms and immunological techniques and analyse experimental data to draw scientific conclusions.

REFERENCES: M.Sc. Zoology- Semester I & II: Animal Physiology

1. G. Giese: Cell Physiology (3 rd Ed) Saunders, Toppan.
2. Gerald Karp: Cell Biology, McGraw Hill Kogakusha Ltd.
3. Darnell, Lodish, Baltimore: Molecular Cell Biology, Scientific American Books.
4. A. Keil, E. Neil & E.N. Jobe (1982): Samson Wright, Applied Physiology, Oxford Univ. Press.
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6. W. A. Hoar (1982): General & Comparative Animal Physiology, 3 rd Ed. Prentice Hall Inc.
7. C. L. Prosser (1973): Comparative Animal Physiology, W. B. Saunders.
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17. Introduction from Rac Silver & Karvey Feder: Hormones & Reproduction Behaviour Scientific Americal (Readings from) W. H. Freeman & Co.
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19. Sujit K. Chaudhuri: Concise Medical Physiology, 2nd Ed. (1993) New Central Book, Agency (P) Ltd., Calcutta
20. Thomas G. M. Schalkhammer (Ed.) Indian Reprint 2004: Analytical Biotechnology – Methods & Tools in Biosciences and Medicine Rajkamal Electric Press, Delhi
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22. Biswajit Mohanty & Sharbari Basu (2006): Fundamentals of Practical Biochemistry B. I. Publications (Pvt.) Ltd., New Delhi
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25. Christopher D. Moyes, Patricia Schulte (2014) Principles of Animal Physiology, Pearson

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ADDITIONAL READING

1. Fusco, G. and Minelli, A., 2010. Phenotypic plasticity in development and evolution: facts and concepts *Phil. Trans. R. Soc. B*, 365, 547–556, doi:10.1098/rstb.2009.0267
2. Schulte P. M., 2014: What is environmental stress? Insights from fish living in a variable environment. *The Journal of Experimental Biology*, 217, 23-34 doi:10.1242/jeb.089722
3. Taborsky B., *Developmental Plasticity: Preparing for Life in a Complex*, University of Bern, Hinterkappelen, Switzerland
4. Lea et al., 2017: Developmental plasticity Bridging research in evolution and human health, *Evolution, Medicine, and Public Health*, pp. 162–175, doi:10.1093/emph/eox019
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<http://dx.doi.org/10.1016/B978-0-12-802151-4.00007-4> Copyright © 2017 Elsevier

SEMESTER I and II
(DISCIPLINE SPECIFIC ELECTIVE: MARINE SCIENCES)
PATTERN FOR THEORY EXAMINATION

Internal: 25M (Assignment/ Seminar/Case Study/ Test)

External: 25M

QUESTION PAPER PATTERN FOR EXTERNAL THEORY EXAM

Maximum Marks: 25

Duration: 1 hr 15 mins

Instructions:

- i. All questions are compulsory.
- ii. All questions carry equal marks.
- iii. Draw neat and labelled diagrams wherever necessary.

Q1: Based on Unit 1: 12.5M

a or a (7.5 MARKS)

b or b (5 MARKS)

Q.2: Based on Unit 2: 12.5M

a or a (7.5 MARKS)

b or b (5 MARKS)

**SKELETON PAPER FOR PRACTICAL EXAMINATION
SEMESTER I**

Duration: 3 HRS

Total Marks: 50

Q.1 Determine the influence of sub-lethal (5 ppm) ammonia concentration on the activity of any one of the following enzyme of a suitable fish species exposed to ammonia stress ;

hepatic glutamate dehydrogenase

OR brain glutamate dehydrogenase

OR Level of excretory ammonia

OR Level of amino acid content of muscle / gill/ brain /liver

15M

Q. 2 Study of the effect of various factors like pH **OR** temperature **OR** activator **OR** inhibitor **OR** substrate concentration on salivary amylase. **12M**

Q.3 Determination of Urea/ Uric acid/ Creatinine content in serum/blood/urine. **05M**

Q.4 Identify and describe the sensory receptors [**Any Two**] **08M**
(photoreceptors, chemoreceptors:-olfactory receptors, gustatory receptors, carotid body; mechanoreceptors, thermoreceptors, electroreceptors, magnetoreceptors)

Q.5 Viva voce **05M**

Q.6 Journal **05M**

**SKELETON PAPER FOR PRACTICAL EXAMINATION
SEMESTER II**

Duration: 3 HRS

Total Marks: 50

Q.1 To determine the effect of osmotic stress on the fish. **15M**

OR

Effect of different salt concentrations on the diameter of RBC.

Q.2 Effect of decreasing partial oxygen pressure of water on respiratory rate of fish. **10 M**

Q.3 Single radial immunodiffusion of antibody and antigen. **07 M**

OR

Evaluation of the Ouchterlony technique for demonstrating immunodiffusion

Q.4 Report on experiments related to model organism **08M**

Q.5 Viva voce **05M**

Q.6 Journal **05M**
