Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Empowered Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for T.Y.B.Sc (under NEP)

PROGRAM: B.Sc. ZOOLOGY

PROGRAM CODE: RJSUZOO

(REVISED in 2025-2026 in alignment with the NEP 2020 facilitating the inter-and multidisciplinary learning and multiple entry and exit of the students)

(CBCS 2025-2026)

PREAMBLE

The National Education Policy 2020 aims at imparting skill-based learning and caters to the multiple entry and exit facility for the students thus empowering them to acquire knowledge at their pace. In the three-year UG program, the student has two exit options. Students also have the option of choosing the Honors program of four years study in a given discipline and later converting it to five-year integrated PG degree program.

As an undergraduate student, he/she learns the core subject (Major), subject complementing the core subject (Minor), a course from other discipline; open elective course (OEC or GEC) and Vocational and Skill Enhancement course from the Major (VSEC). The remaining verticals under NEP 2020 are IKS (Indian Knowledge System), AEC (Ability Enhancement Course), VEC (Value Enhancement Course) and with progressive three years of UG, student also completes at different levels OJT (On Job Training), FP (Field Projects), CEP (Community Engagement Program), RP (Research Project) which helps him/her in understanding their roots, application of the knowledge for the benefit of self and the society. Vertical CC (Co-curricular activities and activities related to yoga and human well-being) helps in preparing youth with good character and interpersonal relationships.

The subject of Zoology offers the basic understanding about the vast diversity of the animal kingdom across the globe. It enables the students to strengthen their knowledge in Animal Sciences and in the other allied branches of Zoology. Keeping the interest of learner in mind, the syllabus has been carefully designed. It has a balance of the classical aspects of Zoology which includes topics like taxonomy, ecology, ethology, developmental biology, physiology, fishery science, animal husbandry and economic entomology. The syllabus also includes applied subjects like biochemistry, pathology, immunology, molecular biology and epidemiology.

The undergraduate curriculum has been meticulously designed by considering the need for the subject development, industry requirement, research outlook, competitive exams and entrepreneurship skills. Each unit included in the syllabus has clearly defined objectives. It focuses on outcome-based learning. It aims at inculcating the critical thinking, enhancing the analytical ability, developing writing skills of the students. The syllabus includes field trips to ecological habitats, agrofarms, national parks, sanctuaries, natural history museum, reputed research institutes and industries to widen the student's horizon. The students are encouraged to participate in various project-based activities.

Owing to the current needs of the industry and other sectors, the syllabi is designed in a manner that the learner will be able to apply the knowledge and skills acquired in varied fields. The course encourages a sense of responsibility and empathy towards all living beings, promoting sustainable practices in the learner.

PROGRAMME OUTCOMES (PO) OF UNDERGRADUATE DEGREE PROGRAMMES

Program outcome refers to the overall characteristic an individual is supposed to acquire on completion of the three-year degree program in Bachelor of Science. The attributes based on acquisition, accumulation, and processing of knowledge of the subject are transferable beyond the discipline and useful in different domains of life.

Critical Thinking: Concepts, methodology and ability to formulate questions stimulate the inquisitiveness and critical thinking amongst the students.

Scientific Temperament: The nurturing of the young minds to observe and analyse the experiments in the laboratory or a phenomenon occurring around them to obtain a logical scientific explanation for it.

Analytical Thinking: The ability to think analytically can be developed by training and practice. The syllabus offers the student to understand the concept and design projects or experiments based on them.

Domain knowledge: The domain knowledge is the key to the understanding of advances and complex subject matter.

Social Ethics: The students are exposed to different problems caused due to human activity. They learn to conduct themselves without creating a damage to fellow beings.

Animal Ethics: The sensitization towards ethical issues associated with use of animals in the laboratory is highlighted and the solutions to overcome it are introduced.

Problem Solving: The ability to handle a situation is enhanced in the students by problem solving assignments, case studies, projects to make them competent, conscious and creative individual.

Environmental Sustainability: Environment related issues are addressed through workshops, Guest lectures and field studies.

PROGRAMME SPECIFIC OUTCOMES (PSOS)-BSc PROGRAMME IN ZOOLOGY

PSO1	Understands the nature and basic concepts of systematic classification, ecology, biomolecules, animal biotechnology, cell biology, and genetics.
PSO2	Analyse and comprehend the concepts of developmental biology, genetics and molecular biology. Acquaint with the skills in fishery biology, animal husbandry and economic entomology to boost entrepreneurship skills.
PSO3	Acquire skills and necessary training for techniques in haematology, immunology, physiology, endocrinology, enzymology, molecular biology, toxicology, cancer biology and field biology. Enhance knowledge on biostatistics, alternate energy, Wild-life tourism. Wildlife conservation and epidemiology to provide wider job prospects in the realm of Zoology.
PSO4	Perform laboratory procedures as per standard protocols in the areas of animal diversity, genetics, biochemistry, molecular biology, physiology, immunology, developmental biology, environmental Science and pollution.
PSO5	Apply ethical principles and knowledge in understanding of Zoology to one's own life and work. Applications of biological sciences in different areas that contributes towards nation building.

SEMESTER	:	**V DSE-I**
TITLE OF THE SUBJECT/COURSE	:	**DSE-I EPIDEMIOLOGY**
COURSE CODE	:	**RJDSEZOO351**
CREDITS	:	**04**
DURATION	:	**60 Lectures**

LEARNING OBJECTIVES	
1	To provide understanding of the basic principles of epidemiology, including its scope, methods, disease progression, and screening.
2	To familiarize the learner key terms and mechanisms of disease transmission, including sources, routes, and incubation periods.
3	To introduce the learner to the various methods of prevention and control of communicable diseases.
4	To impart awareness to learners on major disease eradication efforts and India's role in vaccine development and child immunization programs.

COURSE OUTCOMES	AFTER COMPLETING THE COURSE, THE LEARNER WILL BE ABLE TO:	PSO ADDRESSED	BLOOM'S TAXONOMY LEVEL
CO1	Understand the core concepts, methods, and stages of epidemiology, including disease screening.	3	BT level IV Analyse draw connections among ideas
CO2	explain disease transmission dynamics and apply key terms in prevention and control strategies.	3	BT Level I, II, III remember, understand and apply
CO3	identify major public health initiatives and evaluate India's role in vaccine development and immunization programs and their importance.	3	BT I, IV Remember, identify and categorise

SEMESTER V
DSE-I EPIDEMIOLOGY
PAPER CODE: RJDSEZOO351
Module-I: Scope and perspective of epidemiology, descriptive and analytical epidemiology; epidemiological triad; stages of diseases, screening for diseases. **Module-II:** Definition of common terms, Dynamics of disease transmission, Reservoir, route of transmission, incubation. **Module-III:** Prevention and control of communicable diseases- Notification, isolation, quarantine, disinfection; concurrent, terminal, precurrent / prophylactic methods of disinfection: natural, physical, chemical, immunization; general measures. **Module IV**: Smallpox Eradication Programme, Polio Eradication Programme, Role of India in vaccine Production (COVAXIN), Vaccination programme for children in India.

REFERENCES

1. Park and Park (2015). Text book preventive and social medicine.
2. Schneider, M.J. (2016). Introduction to Public Health, 5th Ed. Jones & Bartlett Publishers
3. Detels, R., Mcewen, J., Beaglehole, R. and Tanaka, H.(2002).Oxford textbook of Public Health Ed, 4th Edition, Oxford University Press (OUP)

SEMESTER	:	**V DSE-II**
TITLE OF THE SUBJECT/COURSE	:	**BEHAVIOURAL BIOLOGY**
COURSE CODE	:	**RJDSEZOO352**
CREDITS	:	**04**
DURATION	:	**60 Lectures**

LEARNING OBJECTIVES	
1	To understand the development of behaviour and mechanisms involved in it.
2	To familiarize the learner with classical experiments associated with behavioural studies .
3	To pique interest in the learner about different behavioural patterns in animals.
4	To develop observational skills in the learner for behavioural studies in surroundings.

COURSE OUTCOMES	AFTER COMPLETING THE COURSE, THE LEARNER WILL BE ABLE TO:	PSO ADDRESSED	BLOOM'S TAXONOMY LEVEL
CO1	Understand the different aspects of behaviour and its role in survival of animals	1	BT level II Understanding of the principles in development of behaviour
CO2	Design experiments related to behaviour studies	1,3,4	BT Level III, IV Apply and analyse
CO3	Understand the reasons for changes in behavioural patterns of animals	3,4	BT IV, V Analyse and evaluate situations

SEMESTER V

DSE-II BEHAVIOURAL BIOLOGY

PAPER CODE: RJDSEZOO352

Module I: Introduction to Animal Behaviour

1.1 Concept of behaviour and scope of behavioural biology
1.2 Historical background and key contributors (e.g., Tinbergen, Lorenz, von Frisch)
1.3 Methods of studying behaviour: observation, ethograms, experimental methods

Module II: Mechanisms of Behaviour

2.1 Neural and hormonal control of behaviour
2.2 Role of sensory organs and nervous system
2.3 Hormonal influences on sexual and aggressive behaviour
2.4 Biological rhythms and circadian clocks

Module III: Development of Behaviour

3.1 Genetic basis of behaviour
3.2 Innate vs learned behaviours
3.3 Imprinting and critical periods (Lorenz's geese)

Module IV: Types of behaviour

4.1 Innate behaviour: characteristics & examples, innate releasing mechanism, significance of instincts.
4.2 Learned behaviour: Imprinting, Conditioned reflex, habituation, instrumental learning and opera
4.3 Protective behaviour: a.Camouflage, Warning colouration b.Mimicry- Batesian & Mullerian, Adaptive & evolutionary significance of mimicry

REFERENCES

1. Animal Behavior: Mechanisms, Ecology and Evolution Stephen Vessey, Elizabeth Jacob, S. H. Vessey and L. C. Drickamer, McGraw-Hill.
2. Animal Behaviour- Mohan Arora
3. An introduction to Animal Behaviour- Manning and Dawkins
4. Principles of Animal Communication. Bradbury, J.W. and S.L. Vehrencamp. Sinauer Assoc. Sunderland, Massachsets, USA.
5. Animal Behaviour- ReenaMathur, Rastogi Publications
6. Animal Behaviour (Ethology)- Dr V K Agarwal, S.Chand Publications

Evaluation and Assessment

(Based on the centralized guidelines given by EC under NEP2020)

Evaluation Scheme (RJDSEZOO351 & RJDSEZOO352)

Internal Evaluation:

20 Marks Test

20 Marks Assignment

Total: 40 marks

External- Semester End Evaluation- **60 MARKS**

Total marks per course – 100 MARKS

THEORY SKELETON PAPER EXTERNAL EXAM

Q1 Based on module -1	**15mks.**
Q2 Based on module -2	**15mks.**
Q3 Based on module -3	**15mks.**
Q4 Based on module -4	**15mks.**

Mapping of the course to Local/ Regional/National/International relevance

Class	Course Name	Course Code	Local relevance	Regional relevance	National relevance	International relevance
T.Y B Sc Zoology	DSE-I Epidemiology	RJDSEZOO 351	Understanding the spread of diseases at local level.	Distribution pattern of diseases in different regions.	Understanding nation's strategies in combating different diseases	Contribution in medicine sector to combat global pandemics.
	DSE-II Behavioural Biology	RJDSEZOO 352	Understanding behaviour patterns in pets as well as surrounding animals.	Impact of regional changes on animal behaviour.	Understanding protective behaviour patterns in varied geography of the nation.	Contribution of researchers globally in the field of ethology.

Mapping of the course to Employability/ Entrepreneurship/Skill development

Class	Course Name	Course Code	Topic focussing on Employability/ Entrepreneurship/skill development	Employability/Entrepreneurship/Skill development	Specific activity
T.Y B Sc Zoology	DSE-I Epidemiology	RJDSEZOO351	Disease screening, Understanding of disease tracking.	Hygiene, sanitation and health care sector.	Immunization programs
	DSE-II Behavioural Biology	RJDSEZOO352	Methods of studying behaviour patterns, Concepts of learned behaviour.	Pet care management, Animal trainers, Assisting Animal psychologists.	Innate and learned behaviour

Integration of Cross cutting Issues

Class	Course Code	Cross Cutting Issues
T Y B Sc Zoology Sem V	RJDSEZOO351 Epidemiology	Ethics, Good health and well being, clean water and sanitation UNSDG 3,4,6, 8 NEP2020 Interdisciplinary
	RJDSEZOO352 Behavioural Biology	Ethics, Life below water, Life on land UNSDG 4, 14,15 NEP2020 Interdisciplinary

SEMESTER VI

SEMESTER	:	**VI DSE-I**
TITLE OF THE SUBJECT/COURSE	:	**PUBLIC HEALTH AND DISEASE**
COURSE CODE	:	**RJDSEZOO361**
CREDITS	:	**04**
DURATION	:	**60 Lectures**

LEARNING OBJECTIVES	
1	To make learners understand the epidemiology and management of viral and bacterial diseases.
2	To acquaint learners with the transmission, prevention, and control of protozoan and helminth diseases.
3	To explore the causes and management of lifestyle-related non-communicable diseases.
4	To equip learners to examine the epidemiology and control of mental health and occupational diseases.

COURSE OUTCOMES	AFTER COMPLETING THE COURSE, THE LEARNER WILL BE ABLE TO:	PSO ADDRESSED	BLOOM'S TAXONOMY LEVEL
CO1	understand the epidemiology and control of major communicable diseases caused by viruses, bacteria, protozoa, and helminths.	3	BT level IV Analyse draw connections among ideas
CO2	identify and explain the causes, prevention, and control of key non-communicable lifestyle diseases.	3 &4	BT Level I, II, III remember, understand and apply
CO3	gain insight into the public health aspects of mental health and occupational diseases.	3	BT I, IV Rember, identify and categorise

SEMESTER VI
DSE-I PUBLIC HEALTH AND DISEASE
PAPER CODE: RJDSEZOO361
Module-I: Epidemiology of communicable diseases: Diagnosis, transmission, prevention, control measures and treatment of- **Viral : dengue , bacterial : TB, leprosy.** **Module-II:** Epidemiology of communicable diseases: Diagnosis, transmission, prevention, control measures and treatment of- **Protozoan : Malaria, Helminth: filariasis.** **Module-III** Epidemiology of Non-Communicable Diseases—causes, diagnosis, prevention, control measures and treatment of lifestyle diseases **Hypertension, Diabetes, Cancers,** **Module-IV** Epidemiology of Non-Communicable Diseases—causes, diagnosis, prevention, control measures and treatment **Mental Health (depression anxiety), Occupational Diseases (Computer vision syndrome).**

REFERENCES

1. A textbook of medical diagnostics- Dr Rajneesh Prajapat and Dr Manivannan Kasturi.
2. Textbook of medical laboratory technology- Praful B. Godkar.
3. Henry's Clinical Diagnosis and Management by Laboratory Methods- By Richard A. McPherson.
4. Laboratory Medicine The Diagnosis of Disease in Clinical Laboratory- By Michael Laposata M.D. Ph.D.

SEMESTER	:	**VI DSE-II**
TITLE OF THE SUBJECT/COURSE	:	**ETHOLOGY**
COURSE CODE	:	**RJDSEZOO362**
CREDITS	:	**04**
DURATION	:	**60 Lectures**

LEARNING OBJECTIVES	
1	To understand the patterns and significance of social behaviour in animals
2	To impart the knowledge of reproductive behaviour patterns evolved in animals
3	To introduce the learner to certain aspects of human behaviour.
4	To develop interest in the learner for anthropological science

COURSE OUTCOMES	AFTER COMPLETING THE COURSE, THE LEARNER WILL BE ABLE TO:	PSO ADDRESSED	BLOOM'S TAXONOMY LEVEL
CO1	Understand the significance of social behaviour in evolution and survival.	1	BT level II, III Understand and apply
CO2	Understand and co-relate social behavioural patterns in other organisms	1,4	BT Level II, IV, V Understand, analyse and evaluate
CO3	Design experiments related to behaviour studies	3, 4	BT Level III, IV Apply and analyse

SEMESTER VI

DSE-II ETHOLOGY

PAPER CODE: RJDSEZOO362

Module I: Introduction to Social Behaviour

1.1 Concept of social organisation, Evolution of social behaviour, grouping
1.2 Types of social organizations: solitary, pair-living, group-living
1.3 Communication: visual, auditory, chemical, tactile

Module II : **Social behaviours in animals**

2.1 Territoriality and Aggression, Schooling in fishes, Herd migration,
2.2 Kin selection, Altruism and reciprocal altruism,
2.3 Social organization in insects and primates.

Module-III : **Mating, Courtship and Parental care**

3.1 Mating systems in animals
3.2 Courtship behaviour- characteristics of courtship, Examples of courtship- Spider, Bower bird, Baya weaver bird.
3.3 Parental care- Concept, Factors affecting parental care, Parental care in fishes and amphibians.

Module VI: Behavioural Ecology and Human Behaviour

4.1 Foraging theory and predator-prey interactions
4.2 Migration and navigation
4.3 Parental care strategies and reproductive tactics
4.4 Human ethology: behavioural traits in humans

Case Studies: Communication in bees, Depression in animals, Pheromone traps

REFERENCES

1. Animal Behavior: Mechanisms, Ecology and Evolution Stephen Vessey, Elizabeth Jacob, S. H. Vessey and L. C. Drickamer, McGraw-Hill.
2. Animal Behaviour- Mohan Arora
3. An introduction to Animal Behaviour- Manning and Dawkins
4. Principles of Animal Communication. Bradbury, J.W. and S.L. Vehrencamp. Sinauer Assoc. Sunderland, Massachsets, USA.
5. Animal Behaviour- ReenaMathur, Rastogi Publications
6. Animal Behaviour (Ethology)- Dr V K Agarwal, S.Chand Publications

Evaluation and Assessment

(Based on the centralized guidelines given by EC under NEP2020)

Evaluation Scheme (RJDSEZOO361 & RJDSEZOO362)

Internal Evaluation:

20 Marks Test

20 Marks Assignment

Total: 40 marks

External- Semester End Evaluation- **60 MARKS**

Total marks per course – 100 MARKS

THEORY SKELETON PAPER EXTERNAL EXAM

Q1 Based on module -1	**15mks.**
Q2 Based on module -2	**15mks.**
Q3 Based on module -3	**15mks.**
Q4 Based on module -4	**15mks.**

Mapping of the course to Local/ Regional/National/International relevance

Class	Course Name	Course Code	Local relevance	Regional relevance	National relevance	International relevance
T.Y B Sc Zoology Sem VI	DSE-I Public health and diseases	RJDSEZOO 361	Understanding the spread of diseases at local level.	Distribution pattern of diseases in different regions.	Understanding impact and statistics of lifestyle diseases affecting the nation.	Global comparison of diseases and their spread.
	DSE-II Ethology	RJDSEZOO 362	Understanding herding behaviour patterns in domesticated animals.	Regional variation in communication between animals.	Understanding distribution of animals for foraging and prey-predator interactions.	Global migration patterns in animals and its impact.

Mapping of the course to Employability/ Entrepreneurship/Skill development

Class	Course Name	Course Code	Topic focussing on Employability/ Entrepreneurship/skill development	Employability/Entrepreneurship/Skill development	Specific activity
T.Y B Sc Zoology Sem VI	DSE-I Public health and diseases	RJDSEZOO361	Communicable and Lifestyle diseases.	Hygiene, sanitation and health care sector.	Treatment of diseases
	DSE-II Ethology	RJDSEZOO362	Social organization, Foraging strategies, Mating behaviour.	Pet care management, Animal Breeders, Wildlife researcher, Zoo-keepers. Anthropologists	Social organization studies.

Integration of Cross cutting IssuesClass	Course Code	Cross Cutting Issues
T Y B Sc Zoology Sem VI	RJDSEZOO361 Public health and hygiene	Ethics, Good health and well-being, clean water and sanitation UNSDG 3,4,6, 8 NEP2020 Interdisciplinary
	RJDSEZOO362 Ethology	Ethics, Life below water, Life on land UNSDG 4, 14,15 NEP2020 Interdisciplinary