


**Scheme of B.Sc.
Zoology**

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
First year	ZOOL-1T	Animal Diversity:Non-Chordata and Chordata , Comparative Anatomy and Physiology of Non-chordates	Theory	4	50	17
	ZOOL-2T	Cell Biology , Histology and Comparative Anatomy & Physiology Of Chordates	Theory	4	50	17
	ZOOL-1P	Practical	Practical	2	50	17
Second year	ZOOL-3T	Genetics , Developmental Biology and Evolution	Theory	4	50	17
	ZOOL-4T	Biochemistry and Molecular Biology	Theory	4	50	17
	ZOOL-2P	Practical	Practical	2	50	17
Third year	ZOOL-5T	Animal Behavior , Chronobiology and Ecology	Theory	4	50	17
	ZOOL-6T	Microbiology , Parasitology , Immunology and Applied Zoology	Theory	4	50	17
	ZOOL-3P	Practical	Practical	2	50	17
Total				30	450	

Note: There shall be four extra credits in all the years of under graduation for internship/apprenticeship. The certificate of extra credits would be provided by the university concern.

Part A: Introduction				
Program : Degree course		Class: B.Sc.III Year	Year -2024	Session :-2024-2025
1	Course code	ZOOL-3P		
2	Course Title	Lab course - 3		
3	Course Type	Practical		
4	Pre-Requisite(If Any)	No		
5	Course Learning Outcome (CLO)	<p>At The end of Course Students will be able to -</p> <ul style="list-style-type: none"> • Learn a wide range of practical techniques used to study animal behaviour. • Develop skills, concepts and experience to understand all aspects of animal behaviour. • Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives. • Understand and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild. • Consider and evaluate behaviour of all animals, including humans, in the complex ecological world, including the urban environment. • Understand causative agents, pathogenesis, diagnosis, prophylaxis, and chemotherapy for various bacterial, viral, protozoan, and helminthic diseases. • Understand the concept of immune mechanisms, their pathways, acquired immunity, hypersensitivity, and autoimmune disorders. • Understand the aquaculture techniques, their problems, and commercial viability. • Understand the techniques and commercial significance of apiculture, sericulture, and lac culture. • Understand the basic and technical skills related to dairy management, poultry, and vermicomposting. 		
6	Credit Value	2		
7	Total marks	Maximum marks : 50 Minimum marks: 17		


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Part : B Content of course

Total lecture-30

**Tentative Practical
List**

**Note :This is tentative list .The teacher concern can add per
requirement**

1. Orientation of an animal to light.
2. Chemical communication in ants.
3. Predatory behaviour of a carnivorous animal.
4. Nests and nesting habits of the birds and social insects
5. To study geotaxis behaviour in earthworm.
6. To study the phototaxis behaviour in insect larvae.
7. Study of circadian functions in humans (daily eating, sleep and temperature patterns).
8. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of
9. Making an ecosystem in a wide-mouthed bottle.
10. Constructing a food web by observing and collecting organisms from a given area.
11. Studying the impact of herbivore on plant species (planted in pots under specific conditions)
12. Estimation of the ratio of the producers and consumers.
13. Studying insect diversity in a habitat.
14. Study of permanent slides and specimens of parasitic protozoans and helminthes.
15. Pathological examination of sputum, blood, urine and stool.
16. Staining and identification of Gram positive and Gram negative bacteria.
17. RBC and WBC counting.
18. Identification of Blood group.
19. Demonstration of antigen-antibody interaction in gel.
20. Morphological characterization of common fish species.
21. Identification of two major carps – *Labeo rohita* and *Catla catla* and their life cycles.
22. Through charts/specimens- study of bees.
23. Worker honey bee with emphasis on leg modifications (through specimens/charts).
24. Life cycle of mulberry silkworm, *Bombyx mori* and tasar silkworm (model/chart/specimens).
25. External morphology and nomenclature of dairy animals.
26. Determination of the specific gravity of milk by using a mercury lactometer.
27. Test for good quality eggs (Floating test, cracking test) and for fertilized and unfertilized eggs (Light test, Cracking test).
28. External morphology of poultry birds (model).
29. Project report on visit to dairy farm and visit to Poultry farm (Poultry management).



Part-C Learning Resource

Text books, References, Books Other Resource :

1. Practical Ecology, Anmol Publications.
2. Practical Methods in Ecology and Environmental Science, R. K. Trivedy, P. K. Goel, C. L. Trisal Enviro Media Publications, 1987.
3. Ethology practical Vilmos Altbäcker Márta Gácsi András Kosztolányi Ákos Pogány Gabriella Lakatos Péter Pongrácz.
4. Animal Behaviour Reena Mathur Rastogi publication.
5. ANIMAL BEHAVIOUR Practical work and data response exercises for sixth form students Michael D.
6. Animal Cell Culture and Technology Michel butcher_Publisher : Taylor & Francis
7. Our Animal Resources: Animals and Their Economic Importance Hardcover.
8. Publisher Holt, Rinehart, and Winston :
9. Practical Microbiology D.K. Maheshwari.
10. practical microbiology R.C. Dubey.
11. microbiology textbook. Dr Arora.
12. Microbiology: A Laboratory Manual - Book by James G. Cappuccino and Natalie Sherman.
13. Micro extremely Lecturio and sketchy rock's.
14. Lehninger – Biochemistry.
15. Kuby – immunology.
16. Ananthnarayan- medical Microbiology.
17. Tortora- for studying diseases caused by the normal flora and antibiotic classes.
18. Stanbury and Whittekar -fermentation Microbiology.
19. Genes by Lewis- for Genetics/ molecular biology and genetic engineering
20. Watson- Molecular biology.
21. Kooper - Cell biology.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

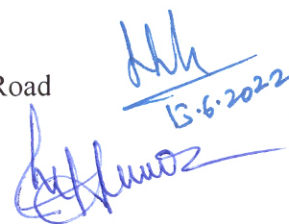
University exam (UE) : Maximum Marks: 50

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable
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DECLARATION

This is to certify that the syllabus is framed by the central board of study (Zoology) as per the guidelines of the department of higher education, Chhattisgarh government.

1. Dr. K. R. Sahu - Chairman -
Assistant Professor, Govt. Pandit Madhav Rao Sapre College, Pendra Road
2. Dr. Ajit Hundet - Member -
Professor, Govt. D. B. Girls College, Raipur


15.6.2022

3. Dr. Prem Prakash Singh - Member - Prem Prakash Singh
Professor, Govt. College, Kusmi, Balrampur 13/06/2022
4. Dr. Shubhada Rahalkar - Member - Shubhada Rahalkar
Professor, Govt. Bilasa Girls P. G. College, Bilaspur 13.6.2022
5. Dr. Anil Kumar Shrivastava - Member - Anil Kumar Shrivastava
Professor, Govt. V. Y. T. P. G. Autonomous College, Durg
6. Dr. R. K. Tamboli - Member - R. K. Tamboli
Assistant Professor, Kirodimal Govt. Arts & Science College, Raigarh 13.6.22
7. Dr. Parmita Dubey - Member - Parmita Dubey
Assistant Professor, Govt. J. Y. Chhattisgarh College, Raipur 13.6.22
8. Dr. Shashi Gupta - Member - Shashi Gupta
Assistant Professor, Govt. Nagarjuna P. G. College of Science, Raipur 13.06.22
9. Dr. L. P. Miri - Member - L. P. Miri
Assistant Professor, Govt. J.P. Verma P. G. Arts & Commerce College, Bilaspur
10. Dr. Rajesh Kumar Rai - Member - Rajesh Kumar Rai
Assistant Professor, Govt. Mahamaya College, Ratanpur, Bilaspur 13.6.22
11. Dr. Hema Kulkarni - Member - Hema Kulkarni
Assistant Professor, Shahid Domeswar Sahu Govt. College, Jamgaon R. Dist -Durg 13/6/22

Date : 13.06.2022.

Part A: Introduction			
Program: Certificate course		Class: B.Sc. IIIrd Year	Year: 2024 Session 2024:2025
1	Course code	ZOOL: 5T	
2	Course Title	Animal Behaviour, Chronobiology and Ecology	
3	Course type	Theory	
4	Pre requisite	NO	
5	Course learning Out comes (CLO)	<p>After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> • Learn a wide range of theoretical and practical techniques used to study animal behaviour. • Develop skills, concepts and experience to understand all aspects of animal behaviour. • Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives. • Understand and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild. • Consider and evaluate behaviour of all animals, including humans, in the complex ecological world, including the urban environment. • Know the evolutionary and functional basis of animal ecology. • Understand what makes the scientific study of animal ecology a crucial and exciting endeavour. • Analyse a biological problem, derive testable hypotheses and then design experiments and put the tests into practice. • Solve the environmental problems involving interaction of humans and natural systems at local or global level. 	
6	Credit value	4	
7	Total Marks	Max. Marks: 50	Minimum. Passing Marks: 17

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Part B : Content of Course		
Total Periods: 60		
Unit	Topics	No. of Period
I	Concept and pattern and control of behaviour Animal behaviour: Scope and importance of study. Concept of behaviour : Motivation, Fixed action of pattern, sign stimulus, Innate releasing mechanism, Action specific energy, Physiological Basis, Learning, Imprinting, Behavioural Genetics, and Evolution of Behaviour. Patterns of behaviour : Kinds of behaviour: foraging behaviour, Territorial behaviour. Mate selection and courtship behaviour. Parental care, Defensive behaviour. Stereotyped Behaviours : Orientation: Kinesis and taxes and Simple Reflex. Neural control And Hormonal Control of Behaviour.	12
II	Innate; Learning behaviour and socio:biology Innate behaviour: communication by sound (cricket vocalizations), Bird song, Echolocation in Bat. Chemical Signalling: Pheromones (types of pheromones) and bee Dance. Schooling behaviour in fish and Flocking Behaviour in Birds. Types of learning: Habituation, Imprinting and types of imprinting :filial and sexual, Classical conditioning, Instrumental learning, Latent learning and Trial and error learning, insight learning. Social behaviour : aggregation, group selection, kin selection, altruism.	14
III	Chronobiology : Biological clocks, biological rhythms: Circadian and circannual rhythms. Tidal, solar and lunar rhythms, entrainments. Biological oscillation. The concept of Average, amplitude, phase and period. Role of melatonin. Applications of Chronobiology: Chrono pharmacology, Chrono medicine, Chronotherapy. Migratory behaviour in birds and fishes.	11
IV	An overview of ecology, ecosystems and population ecology Structure and function of ecosystem: Major ecosystems of the world. Law of limiting factors. Ecological succession. Energy flow in ecosystem, food chain and food web. Recycling of nutrients: C, N, P & S cycle. Ecology of populations: Density, natality, mortality, Fertility and fecundity, survivorship curves. Unique and group attributes of population: mortality, age ratio and age pyramid, sex ratio, dispersal. Factors regulating population dispersal and growth: Exponential and logistic growth. Population regulation: Density:dependent and independent factors; r and K strategies.	12

V	Biotic community, environmental degradation: Community characteristics: stratification; dominance, diversity, species richness, abundance, evenness, similarity. diversity and food:web indices. ecotone and edge effect. Types of interaction: Positive interactions: commensalism, proto:cooperation, and mutualism. Negative interactions: parasitism and allelopathy; predation and predator:prey dynamics; herbivory. Interspecific competition and coexistence. Environmental ethics; Pollution: Air, water and noise pollution and their control. Natural resources, Mineral, water and forest, their significance and conservation. Types of biodiversity, Hotspots, benefit and threat of conservation strategies.	11
Key words – Innate and Learning Behaviour, Sociobiology, Biological clock, Circadian rhythm, Population, Community, Succession, Pollution, Biological interaction, Biodiversity.		

Part : C Learning Resource	
Text books, Reference Books, Other Resources: <ol style="list-style-type: none"> 1. McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited, London, UK. 2. Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6th edition) Ca 3. Alcock, J. (2005) Animal Behaviour (8th edition) Sinauer Associate Inc., USA. 4. Sherman, P. W. and Alcock, J. (2013) Exploring Animal Behaviour (6th edition) Sinauer Associate Inc., Massachusetts, USA. 5. Dunlap, J. C.; Loros, J.J. and DeCoursey, P. J. (2009) Chronobiology Biological Timekeeping (1st edition) Sinauer Associates, Inc. Publishers, Sunderland, MA, USA. 6. McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited, London, UK. 7. Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6th edition) Ca 8. McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited, London, UK. 9. Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6th edition) Ca 10. Alcock, J. (2005) Animal Behaviour (8th edition) Sinauer Associate Inc., USA. 11. McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited, London, UK. 12. Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6th edition) Ca 13. McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited, London, UK. 	

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15. Alcock, J. (2005) Animal Behaviour (8th edition) Sinauer Associate Inc., USA.
16. Sherman, P. W. and Alcock, J. (2013) Exploring Animal Behaviour (6th edition) Sinauer Associate Inc., Massachusetts, USA.
17. Dunlap, J. C.; Loros, J.J. and DeCoursey, P. J. (2009) Chronobiology Biological Timekeeping (1st edition) Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.
18. Kumar, V. (2002). Biological Rhythms: Narosa Publishing House, Delhi/ Springer : Verlag, Germany. mbridge, University Press, UK
19. Colinviaux, P. A. (1993) Ecology (2nd edition) Wiley, John and Sons, Inc.
20. Krebs, C. J. (2001) Ecology (6th edition) Benjamin Cummings. 57
21. Odum, E.P., (2008) Fundamentals of Ecology. Indian Edition. Brooks/Cole.
22. Ricklefs, R.E. (2000) Ecology (5th edition) Chiron Press.
23. Southwood, T.R.E. and Henderson, P.A. (2000) Ecological Methods (3rd edition) Blackwell Sci.
24. Kendeigh, F C. (1984) Ecology with Special Reference to Animal and Man. Prentice Hall Inc.
25. Stiling, P. D. (2012) Ecology Companion Site: Global Insights and Investigations. McGraw Hill Education.

E:Resources:


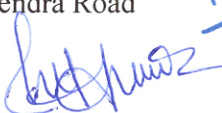
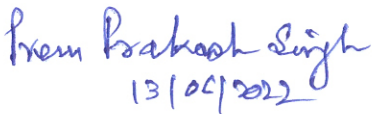
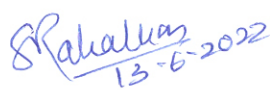

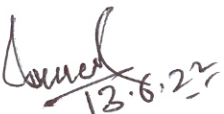
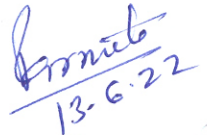


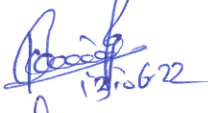
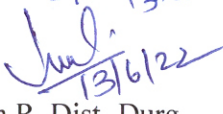
1. SWAYAM: <https://swayam.gov.in/explorer?searchText=>
2. <https://academic.oup.com>
3. <https://medineplus.gov>
4. <https://ncin.nlm.nih.gov>
5. <https://zoologylearningpoint.woodpress.com>
6. <https://zoologyresources.com>
7. National digital library – <https://ndl.iitkgp.ac.in>
8. e:PG Pathshala (MHRD) Portal, <https://egpg.inflibnet.ac.in>
9. Science Direct Open Access Content
10. <https://www.sciencedirect.com/book/9781843342038/> open Access
11. <https://egyankosh.ac.in>
12. <https://Sciencedirect.com>
13. <https://Britannica.com> > science > animal :behaviour
14. <https://www.nontesonzoology.com> > animal behaviour
15. <https://www.biologyonline.com>
16. <https://www.sciencing.com> > Science > Biology > Ecology
17. <https://www2.hcmuf.edu.vn>
18. <https://www.researchgate.net>

Part D: Assessment and Evaluation

University Exam(UE): Maximum Marks: 50 Marks

DECLARATION

This is to certify that the syllabus is framed by the central board of study (Zoology) as per the guidelines of the department of higher education, Chhattisgarh government.

- | | | | | |
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13/6/22 |
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Date : 13.06.2022.

Part A: Introduction			
Program: Certificate Course		Class: B.Sc. III rd Year	Year: 2024 Session: 2024-2025
1	Course Code	ZOOL – 6 T	
2	Course Title	Microbiology, Parasitology, Immunology and Applied Zoology	
3	Course Type	Theory	
4	Pre-requisite (if any)	No	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> Understand causative agents, pathogenesis, diagnosis, prophylaxis, and chemotherapy for various bacterial, viral, protozoan, and helminthic diseases. Understand the concept of immune mechanisms, their pathways, acquired immunity, hypersensitivity, and autoimmune disorders. Understand the aquaculture techniques, their problems, and commercial viability. Understand the techniques and commercial significance of apiculture, sericulture, and lac culture. Understand the basic and technical skills related to dairy management, poultry, and vermicomposting. 	
6	Credit Value	4	
7	Total Marks	Max. Marks: 50	Min Passing Marks : 17

Part B: Content of the Course		
Total Periods: 60		
Unit	Topics	No. of Period
I	Microbiology and Parasitology : Bacterial diseases – Caused by <i>Salmonella typhi</i> , <i>Helicobacter pylori</i> and <i>Mycobacterium tuberculosis</i> with their pathogenesis, diagnosis, prophylaxis, and chemotherapy. Viral diseases – Hepatitis, influenza, AIDS, with their pathogenesis, diagnosis, prophylaxis, and chemotherapy. Protozoan diseases – Amoebiasis, Malaria, Trypanosomiasis, and Leishmaniasis with the life cycle of pathogen and possible treatments. Helminthic diseases – Schistosomiasis, Taeniasis, Ascariasis, and Filariasis with the life cycle of pathogen and possible treatment.	12
II	Immunology : Cells and organelles of the immune system. Characteristics of antigen, Antigenicity, Immunogenicity, Epitopes, Haptens, Adjuvant. Immunoglobulin : Classification, properties, and function of immunoglobulin. Antigen, and Antibody interaction. Humoral and cell-mediated immune response. The role of B and T cells in immunity. MHC complex, Hypersensitivity. Autoimmune disorders: Thyroid problem, Rheumatoid Arthritis . Monoclonal antibodies. Concept of vaccine.	12
III	Aquaculture : Prawn culture – Prawn culture in freshwater, its preservation, and processing. Pearl culture – Biology and technology followed (Fresh & Marine). Fish culture –Maintenance of fresh water fish farm and Breeding, Composite fish farming.	12
IV	Apiculture, Sericulture, Lac culture : Apiculture – types of the honey bee and culture technology. Lac culture – cultivation process with the life cycle of lac insect. Sericulture – types of silkworm and technology for mulberry silk worm culture. Economic values of Apiculture, Sericulture and Lac culture.	11
V	Dairy Management, Poultry farming, and Vermicomposting : Dairy Management : Techniques for dairy management; Cattle disease. Poultry – Types of breeds, rearing methods and diseases. Biology and rearing method of earthworm <i>Eisenia foetida</i> / <i>Pharitima Posthuma</i> . The technology of Vermicompost production.	13
Keywords: Micro organism, Parasites, Immune System, Economic Zoology, Dairy Management, Poultry Management, Vermicomposting.		


 13.6.2022

Part C : Learning Resource

Text Books, Reference Books, Other Resources –

1. Jawetz, M., and Adelberg (2015) Medical Microbiology (27 th edition).
2. Chatterjee, K.D. (2015) Parasitology (13 th edition).
3. Goldsby, R.A.; Kindt, T.J. and Kuby, J. (2006) Immunology (6th edition).
4. Roitt, I.; Brostoff, J. and Male, D. (2012) Immunology (8th edition).
5. Shukla, G.S. and Upadhyaya, V.B. (1999:2000). Economic Zoology (Rastogi Publishers).
6. Mani, M.S. (2006). Insects, NBT, India.
7. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.

E: Resources –

1. SWAYAM: <https://swayam.gov.in/explorer?searchText>
2. <https://academic.oup.com>
3. <https://medineplus.gov>
4. <https://ncin.nlm.nih.gov>
5. <https://zoologylearningpoint.woodpress.com>
6. <https://zoologyresources.com>
7. National digital library – <https://ndl.iitkgp.ac.in>
8. e:PG Pathshala (MHRD) Portal, <https://egpg.inflibnet.ac.in>
9. Science Direct Open Access Content – [https://www.sciencedirect.com/book/9781843342038/open Access](https://www.sciencedirect.com/book/9781843342038/open%20Access)
10. <https://egyankosh.ac.in>

Part D: Assessment and Evaluation

Maximum Marks, University exam. (UE) : : 50

DECLARATION

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- | | | | |
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13.6.2022
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13.6.22

7. Dr. Parmita Dubey - Member -
Assistant Professor, Govt. J. Y. Chhattisgarh College, Raipur
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Date : 13.06.2022.