

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus For T.Y.B.Sc. Zoology (NEP 2024 Pattern)

(Based on NEP 2020 framework 2024 pattern)

(To be implemented from the Academic Year 2026-27)

Level:- 5.5 (Third Year)

Sem:-V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
MajorCore T(2+2+2+2 or4+2+2or 4+4)P(2+2 or4)	24ScZooU5101	Evolution	2		2		20	30	50
	24ScZooU5102	Developmental Biology	2		2		20	30	50
	24ScZooU5103	Biochemistry	2		2		20	30	50
	24ScZooU5104	Human Physiology	2		2		20	30	50
	24ScZooU5105	LabCourseon24ScZooU5101&24ScZo oU5102		2		4	20	30	50
	24ScZooU5106	LabCourseon24ScZooU5103& 24ScZooU5104		2		4	20	30	50
Major Elective(T/P) (2+2 or 4)	24ScZooU5201	Wildlife Conservation and Management	2		2		20	30	50
	24ScZooU5202	LabCourseon24ScZooU5201		2		4	20	30	50
	24ScZooU5203	Microbiology, Parasitology & Immunology	2		2		20	30	50
	24ScZooU5204	Lab Course on 24ScZooU5203		2		4	20	30	50
VSCP(2)	24ScZooU5501	Lab Course on Wildlife Biology		2		4	20	30	50
FP(2)	24ScZooU5001	Field Project II		2		4	20	30	50
Minor (T/P) (2)	24ScZooU5302	Vector,Diseases and Control	2		2		20	30	50
Total			12	10	12	20			550

Level:- 5.5 (Third Year)

Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
MajorCore T(2+2+2+2 or4+2+2or 4+4)P(2+2or 4)	24ScZooU6101	Ecology	2		2		20	30	50
	24ScZooU6102	Entomology	2		2		20	30	50
	24ScZooU6103	Molecular Biology	2		2		20	30	50
	24ScZooU6104	Endocrinology	2		2		20	30	50
	24ScZooU6105	LabCourseon24ScZooU6103& 24ScZooU6104		2		4	20	30	50
	24ScZooU6106	LabCourseon24ScZooU6101& 24ScZooU6102		2		4	20	30	50
Major Elective(T/P) (2+2 or 4)	24ScZooU6201	Neuroscience	2		2		20	30	50
	24ScZooU6202	LabCourseon24ScZooU6201		2		4	20	30	50
	24ScZooU6203	Biostatistics & Bioinformatics	2		2		20	30	50
	24ScZooU6204	LabCourseon24ScZooU6203		2		4	20	30	50
VSCP(2)	24ScZooU6501	Lab Course on Biotechniques		2		4	20	30	50
OJT (2)	24ScZooU6004	On Job Training		4		8	40	60	100

Total			10	12	10	24		550
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Subject: Zoology Semester- V

Major Paper-9 Section- I (T)

Course Code: 24ScZooU5101

TYBSC NEP (2024) syllabus

Credits: 2C (Theory)

Course Name: Evolution

Course Objectives:

1. Understand the origin of life and evidence supporting evolution.
2. Compare major evolutionary theories.
3. Apply concepts of isolation and speciation to explain species formation.
4. Evaluate macroevolution, adaptive radiation, and extinction in relation to geological time.
5. Interpret key biogeographical patterns, including island biogeography.
6. Assess human evolution and its applications in medicine, agriculture, and conservation.

Course outcomes: After successfully completing the course, the students will be able to

1. Explain the origin of life and evidences of evolution.
2. Compare and analyse major evolutionary theories.
3. Apply concepts of isolation and speciation to interpret species formation.
4. Evaluate macroevolutionary processes, adaptive radiation, and extinction events with reference to the geological time scale.
5. Interpret biogeographical patterns, especially island biogeography and animal distribution.
6. Assess human evolutionary trends and communicate applied perspectives in medicine, agriculture, and conservation.

Theory

Unit-I	Foundations of Evolutionary Biology	Lectures
	• Introduction – scope, history, and importance of evolutionary biology • Origin of life – Oparin–Haldane hypothesis, Miller–Urey experiment • Origin of eukaryotic cell • Evidences for evolution – fossils, comparative anatomy, embryology, molecular	4
Unit-II	Theories of Evolution	Lectures
	• Lamarckism and Darwinism • Mutation theory and Modern synthesis • Case studies supporting evolutionary theories	3
Unit-III	Mechanisms, Isolation & Speciation	Lectures
	• Variation, mutation, genetic drift, and gene flow • Isolating mechanisms – pre-zygotic and post-zygotic • Species concepts and types of speciation (allopatric, sympatric, parapatric) • Mechanisms and patterns of speciation • Factors influencing speciation	5
Unit-IV	Evolutionary Processes & Geological Time Scale	Lectures
	• Macroevolution and coevolution • Adaptive radiation – examples (Darwin’s finches, cichlids) • Convergent and divergent evolution • Geological time scale – major eras and periods • Extinction events and their evolutionary impact • Evo-devo – developmental biology and evolution	6
Unit-V	Biogeography & Animal Distribution	Lectures
	• Methods and classification of animal distribution • Patterns and factors affecting distribution • Island biogeography – theory and case studies • Biogeographical realms with reference to fauna • Zoogeography case studies • Applied biogeography in conservation	6
Unit-VI	Human Evolution & Applied Perspectives	Lectures
	• Evolution of primates and anthropoids • Human lineage – Australopithecus to Homo sapiens • Cultural evolution and tool use • Evolutionary medicine – resistance and adaptation • Evolution in agriculture and conservation genetics • Future directions – synthetic biology, evolutionary predictions, experiential learning	6

References

1. Campbell, N. and Reece, J. (2014) Biology (10th edition). Benjamin Cummings
2. Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing.
3. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).
4. *Evolution*. Cold Spring, Harbour Laboratory Press.
5. Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers

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Subject: Zoology Semester- V

TYBSC NEP (2024) syllabus

Major Paper-9 Section- I (T)

Credits: 2C (Theory)

Course Code: 24ScZooU5102

Course Name: Developmental Biology

Teaching Scheme: **2 hours/week**

Total Number of Lectures: **30**

Credits: **2 C** Examination

Scheme: CIA: 20 Marks and End-Semester: 30 Marks

Course Outcomes:

1. The student would gain clarity regarding basic concepts of developmental
2. Student would be understood the basic concepts of gametes and gamete formation
3. The student would know fertilization process blastulation and gastrulation
4. The student would know developmental processes found in animals
5. The student would gain and insight in the Evo-Devo approach
6. The students should develop knowledge of embryogenesis of the chick as a developmental model

Course Contents

Unit 1	Introduction to Developmental Biology	2 L
	1.1. Brief history and scope of Developmental Biology 1.2. Basic terminology and concepts in Developmental Biology	
Unit 2	Gametogenesis	6 L

	2.1 Spermatogenesis: Phases and spermiogenesis 2.3. Sperm: general structure- Human 2.4. Oogenesis: Phases and vitellogenesis 2.5 Ovum: general structure 2.6. Egg membranes: primary, secondary and tertiary 2.7 Oocyte maturation: role of MPF (Maturation Promotion Factor) 2.8 Types of eggs	
Unit 3	Fertilization	6 L
	3.1. Concept and types of fertilization 3.2. Attraction of gametes: sperm activation, chemotaxis 3.3. Sperm penetration: acrosome reaction, capacitation & decapacitation 3.4. Activation of ovum: fertilization cone; polyspermy prevention: fast block (fertilization potential) and slow block (cortical reaction) 3.5. Significance of fertilization	
Unit 4	Cleavage and Blastula	2 L
	4.1. Mechanism of cleavage 4.2. Patterns / Types of cleavage 4.3. Significance of cleavage 4.4 Types of blastulae 4. 5 Significance of blastulation	
Unit 5	Gastrulation	4 L
	5.1 Concept of Gastrulation 5.2 Morphogenetic movements: epiboly, emboly, convergence, invagination, ingression and involution, Fate map,. 5.3 Embryonic induction and organizers-Spemann-Mangold experiment 5.4 Organogenesis: cell differentiation, tissue differentiation and organ formation up to rudimentary stage	
Unit 6	Chick Embryology	6 L
	6.1. Structure of Hen's egg 6.2. Fertilization and cleavage 6.3. Gastrulation: Formation of primitive endoderm, Primitive streak development, Head process and regression of Primitive streak 6.4. Development of nervous system, heart and blood vessels, digestive system up to 48 hours	
Unit 7	Extra-embryonic membrane and Teratogenesis	4 L

	6.1 .Origin, structure and functions of: Amnion, Allantois, Yolk sac, Chorion and placenta., Development of chorio-allontic membrane 6.2 .Teratogenesis: Teratogenic agents and their effects on embryonic development.	
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Reference Books:

1. An Introduction to Embryology 2012, 5thEdn., Balinsky B. L., Fabian B. C. Brooks Cole Pub. Co., USA.
2. Developmental Biology: Patterns, principle and problems, 1982, Saunders J. W., Prentice Hall CollDiv.
3. Developmental Biology 1992 3rd den Browder L. W., Erickson C.A. & Jeffery W. R., Saunders college pub., London.
4. Developmental Biology, 2013, 10thEdn. Gilbert S. F., SinauerAssociatesInc.
5. Analysis of Biological Development, Second Edition, 2001, Klaus Kalthoff, McGraw- Hill.
6. Lewis Wolpert (2010). Principles of Development. II Edition, Oxford University Press
7. Verma P.S. and Agrawal V.K., Chordata Embryology (2010) (S Chand Publication)
8. Carlson, R. F. Patten's Foundations of Embryology

Internet Reference:

<https://plato.stanford.edu/entries/evolution-development/>

Course Code: **24ScZooU5103**

Teaching Scheme: 2 Lectures/Week

Examination Scheme: CIA: 40 Marks

Prerequisites: F.Y.B.Sc. with subject Zoology from MCASC (Auto)/ SPPU/Any Govt. approved University]

Course Name: **Biochemistry**

Total Number of Lectures: 30 Credit: 2C

End-Semester: 60 Marks

Course Objectives:

- To learn the basics of biochemistry.
- To understand the chemistry and the biological significance of the biomolecules.
- To know the clinical significance of these biomolecules.

Course Outcomes:

- The student will be able to use the knowledge of structures and functions of biomolecules in understanding their metabolism.
- Interrelationship between the biomolecules will be understood

Unit 1	Basic Biochemistry	4 Lectures
	• Bonds – Types: Ionic, Covalent, Non-Covalent (hydrogen, hydrophobic, Van der Waals forces) and their significance in biomolecules. • Water, Structure (liquid, ice, colloid), ionic product of water, physicochemical properties, water as an ideal biological solvent. • Concept of Acid, Base and pH - Theories of acids and bases, Sorenson's scale, derivation of Henderson-Hasselbach equation and its applications. • Concept of Buffer- Types of buffers in biological system (Phosphate and Bicarbonate) • Concept of Bio-energetics – Laws of Thermodynamics, free energy, entropy and enthalpy.	
Unit 2	Introduction to Metabolism	2 Lectures
	• Definition and Concept – Metabolism and Metabolic pathway • Anabolism and Catabolism • Types of Metabolic pathways	

Unit 3	Carbohydrates	5 Lectures
	- Recapitulation - Definition, classification and nomenclature of carbohydrates - Structural and Stereo-isomerism - Stereo-chemical properties – anomers, epimerism, mutarotation, racemisation. - Biological and clinical significance of carbohydrates – Hypoglycemia and Hyperglycemia - Introduction to carbohydrate metabolism – Glycolysis and Krebs cycle	
Unit 4	Amino acids	3 Lectures
	- Classification and structures of amino acids - Properties of amino acids - Introduction to amino acid metabolism – Oxidative degradation - Metabolism of ammonia	
Unit 5	Proteins	4 Lectures
	- Peptide bond – formation and characteristics - Types of protein structures – Primary, secondary, tertiary and quaternary (One example of each type), bonds responsible for protein structures. - Introduction and concept of Ramchandran Plot - Biological and Clinical significance of Proteins - Introduction to protein metabolism – Urea cycle	
Unit 6	Lipids	3 Lectures
	- Introduction and classification of lipids - Biological significance of lipids - Clinical significance – Obesity, Atherosclerosis and Myocardial infarction. - Introduction to Lipid metabolism – Beta oxidation	
Unit 7	Nucleic acids	2 Lectures
	- Properties of nucleic acids - Structure and function – DNA - Structure and function – RNA	
Unit 8	Vitamins & Minerals	2 Lectures
	- Concept of Macronutrients and Micronutrients - Vitamins – classification, biochemical functions, deficiency disorders - Minerals – classification, biochemical functions, deficiency disorders	

Unit 9	Enzymes	5 Lectures
	• Classification and properties of enzymes • Types of enzymes -Regulatory and Non-regulatory • Enzyme kinetics – Importance of MM equation and LB plot, • Factors influencing enzyme activity – pH, temperature, enzyme concentration and substrate concentration. • Reversible and irreversible enzyme inhibition • Introduction - Isozymes, Allosteric enzymes, Ribozymes and Immobilised enzymes • Biological and Clinical significance of enzymes – PKU and AKU	

REFERENCES:

1. Lehninger's Principles of Biochemistry, 5th edition (2008) Nelson D.L and Cox M.M, W.H. Freeman and Co. N.Y.
2. Biochemistry, 3rd edition (2008) Dr. U. Satyanarayana, Dr. U. Chakrapani
3. Biochemistry, 3rd edition (2005) Voet Donald and Voet Judith G. John, Wiley and sons publishers, N.Y. U.S.A
4. Zubay
5. Instant notes of Biochemistry, Tywmann
6. Medical Biochemistry
7. Schwamm series

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Subject - Zoology Semester- V
Theory- 2 Credits (30 lectures)
Teaching Scheme: TH: 2 Lectures/Week
Examination Scheme: CIA: 20 Marks

T.Y. B.Sc. Zoology syllabus
Course: Human Physiology
Subject code – 24ScZooU5104
End-Sem: 30 Marks

About the course:

The course provides an insight into the structure and function of organ systems in humans and their involvement in body metabolism towards maintenance of homeostasis.

Learning outcomes: After successfully completing this course, the students will be able to:

1. Understand the process of digestion and excretion and its control
2. Develop understanding in muscle structure and contraction mechanism
3. Learn the process of respiration and transport of gases
4. Understand kidney structure and regulation of urine formation
5. Understand heart structure and functioning
6. Understand structure of reproductive system and process of gametes formation.
7. Student would be able to correlate the physiological processes of mammals and relationship of tissue-organ systems.

Unit 1	Physiology of digestion and excretion accomplished in man	6
	1.1. Digestive glands: Structure and function. Digestion and absorption of nutrients: carbohydrates, fats and proteins. 1.2. Nutrition: Concept of nutrition and energy requirements 1.3. Neural and hormonal control of digestion.	
Unit 2	An overview of muscular function and respiration	7 L

	2.1. Structure of smooth, skeletal and cardiac muscles. Neuromuscular junction. Mechanism of muscle contraction. 2.2 muscle twitch, tetanus and fatigue, rigor mortis, isotonic and isometric contractions. 2.3. Respiration: Ventilation, External and internal respiration. Transport of carbon dioxide and oxygen in blood and tissues. Factors affecting gaseous transport. 2.4. Respiratory Quotient and BMR 2.5. Definitions of acidosis, alkalosis, asphyxia, hypoxia, anoxia & cyanosis.	
Unit 3	Cardiovascular functions	6 L
	3.1. Structure of heart. Coordination of heartbeat; control of heart beat (neural and hormonal) 3.2. Cardiac cycle. ECG. Lymph and lymph vessels. 3.3. Definitions and significance of pacemakers, electrocardiogram, Eco-cardiograph, colour doppler, angioplasty, angiography, angina pectoris, Heart attacks and coronary bypass.	
Unit 4	Reproductive physiology	6 L
	4.1. Structure of ovaries and testes. 4.2. Menstrual cycle and Estrus cycle 4.3. Fertilization and implantation. 4.4. Pregnancy and Parturition. 4.3. Hormonal control of pregnancy, parturition and lactation.	
Unit 5	Excretory system	5 L
	5.1. Functional anatomy of kidney. Mechanism of excretion and regulation of urine formation. 5.2. Definitions and clinical significance of- renal failure, renal calculi, dialysis	

Recommended readings:

1. Tortora, G.J. and Derrickson, B.H. (2009) Principles of Anatomy and Physiology (12th edition) John Wiley and Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology (9th edition) McGraw Hill.
3. Guyton, A.C. and Hall, J.E. (2011) Textbook of Medical Physiology (12th edition) Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
4. Marieb, E. (1998) Human Anatomy and Physiology (4th edition) Addison-Wesley.
5. Kesar, S. and Vashisht, N. (2007) Experimental Physiology, Heritage Publishers.
6. Barret, K.; Brooks, H.; Boitano, S. and Barman, S. (2010) Ganong's Review of Medical Physiology (23rd edition) Lange Medical.
7. Guyton, A.C. and Hall, J.E. (2006) A text book of Medical Physiology (11th edition) Saunders.
8. Keele, C.A. & Neil, E. (1989) Samson Wright's Applied Physiology (13th edition) Oxford.
9. A Text book of General Physiology- P. H. Mistecheil.
10. Introduction of Physiology-Davson (I & II).
11. A Text book of Animal Physiology- M. Arora.
12. General Endocrinology- Turner & Bungera.
13. A Text book of Physiology- Chaterjee.

14. A Text book of Physiology- Nagabhushnum.
15. A Text book of Physiology & Biochemistry- G. H. Bell; C. R. Paterson & E. Smith.

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Subject: Zoology

Semester- V

TYBSC NEP (2024) syllabus

Course Code: 24ScZooU5105

Credits: 2C (Practical)

Course Name: Lab Course on 24ScZooU5101 & 24ScZooU5102

Sr. No.	Name of Practicals	No. of Practical
Section I- Evolution		
1.	Study of Fossils (Museum/Replica/Charts)	1P
2.	Comparative Anatomy – Homologous and Analogous Structures	1P
3.	Vestigial Organs in Animals	1P
4.	Adaptive Radiation (Darwin's Finches/Other Examples)	1P
5.	Mimicry and Protective Coloration	1P
6.	Speciation Models (Simulation/Charts)	1P
7.	Zoogeography of Animals	1P
8.	Island Biogeography by Simulation	1P
9.	Successive Stages of Human Evolution (Models/Charts)	1P
10.	Applied Evolution – Case Studies (Study antibiotic resistance in bacteria)	1P
Section II- Developmental Biology		
1.	Study of sperm smear (any one animal), types of eggs (insect, amphioxus, frog and hen)	1P
2.	To study the types of blastulae and gastrulae (amphioxus, frog and hen)	1P
3.	Study of whole mount slides of chick embryology – 24h, 33hr and 48hr	1P
4.	To study the sections of chick embryo--24hr, 33hr and 48 hrD	1P
5.	Ex-ovo culture of chick embryo	1P
6.	Temporary preparation of chick embryo	1P
7	Study of administration of drug/test material chick embryo	

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Subject: Zoology

Semester- V

TYBSC NEP (2024) syllabus

Course Code: 24ScZooU5106

Credits: 2C (Practical)

Course Name: Lab Course on 24ScZooU5103 & 24ScZooU5104

Sr. No.	Name of Practicals	No. of Practical
	Section I- Biochemistry	
1.	Study of preparation of different solutions – Normality, Molarity, Molality, percent solutions, ppm.	1P
2.	Study of preparation of standard acid, alkali and its standardization	1P
3.	Detection of carbohydrates (monosaccharides, disaccharides and polysaccharides) with the help of suitable tests	1P
4.	Estimation of Vitamin C by Titrimetric method	1P
5.	Isolation of Casein by adjusting the isoelectric point	1P
6.	Estimation of protein by Biuret and Lowry method	1P
7.	Understanding the properties of lipids – solubility, saponification and peroxidation	1P
8.	To study the effect of pH, temperature and inhibition on salivary amylase	1P
9.	Understanding the deficiency disorders caused by Vitamins and Minerals	2P
	Section II-Human Physiology	
1.	To study the Body Mass Index (BMI) and BMR	1P
2.	To determine Erythrocyte Sedimentation Rate (ESR)	1P
3.	To Determine the Ratio of Albumin and Globulin.	1P
4.	To study the mean body temperature	1P
5.	To determine tidal volume and vital capacity of lung	1P
6.	Study of Pulse Rate and heart beats and its irregularities.	1P
7.	Study of working & usage of stethoscope	1P
8.	To Study Sperm count and sperm motility from given sample.	1P
9.	Study of Contraceptive devices.	1P
10.	To study Urine Dipstick Analysis method (Glucose & Ketones)	1P

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SUBJECT - ZOOLOGY

Semester- V

T.Y. B.Sc. Zoology syllabus

Theory- 2 Credits (30 lectures)

Course: Wildlife Conservation and Management

Teaching Scheme: TH: 2 Lectures/Week

Subject code – 24ScZooU5201

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

About the course

The course is an introduction to wildlife management and gives an account of the tools used by wildlife managers. Topics covered are to equip students with adequate knowledge of various biodiversity monitoring methodologies, conservation and management issues of vertebrate pests, wildlife conflict and over abundant species, wildlife health and diseases.

Course outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of how animals interact with each other and their natural environment
2. Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues
3. Develop the ability to work collaboratively on team-based projects
4. Demonstrate proficiency in the writing, speaking, and critical thinking skills needed to become a wildlife technician
5. Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management
6. Develop an ability to analyze, present and interpret wildlife conservation management information.
7. **Describe the role of protected areas** like national parks, wildlife sanctuaries, and biosphere reserves in wildlife protection

Unit 1	Value of wildlife and need for its conservation	8L
	1.1 Introduction to Wildlife– Definition, value and importance of wildlife 1.2 Ecosystems and Wildlife Habitats – Types of ecosystems (forest, grassland, desert, aquatic, Wetland) and their role in supporting wildlife diversity. 1.3 Population Vulnerability Analysis – Basic concept, components and importance in wildlife conservation planning. 1.4 Extinction of Animals – Natural and anthropogenic factors responsible for the extinction of species. Protected Areas and Conservation Strategies – Types of protected areas (National Parks, Wildlife Sanctuaries, Biosphere Reserves) and concept of zoning within protected areas.	

	1.5 Animal Movement and Monitoring – Theories of population dispersal; concept of home range and territory; Tracking movement by camera, drone, remote sensing and GIS.	
Unit 2	Population and prey-predator dynamics	7L
	2.1 Wildlife conservation, ethics and importance of conservation; role of wildlife in maintaining ecosystem balance and biodiversity. 2.2 Impact of environmental factors such as topography, geology, soil and water on wildlife 2.3 Causes of depletion of wildlife 2.4 Impact of habitat destruction on wildlife 2.5 Impact of fragmentation on wildlife 2.6 Biological parameters affecting wildlife populations such as food, cover and forage. 2.7 Predator–prey relationships and models; impact of predation on population dynamics.	
Unit 3	Wildlife Conservation	7 L
	3.1 Wildlife conservation objectives, strategies and major conservation issues; importance of biodiversity conservation and sustainable wildlife management. 3.2 Captive breeding techniques; translocation and reintroduction of endangered species in conservation programmes. 3.3 Inviolate areas and critical habitats and their role in wildlife protection. 3.4 Damage caused by wildlife in India and its mitigation 3.5 Protected Areas and Conservation Strategies – Types of protected areas (National Parks, Wildlife Sanctuaries, Biosphere Reserves) and concept of zoning within protected areas. 3.6 Wildlife conservation in India: Project Tiger, Fireflies, turtle festival	
Unit 4	Rehabilitation and management	8L
	4.1 Types of wildlife management – manipulative and custodial management; objectives and principles of wildlife management. 4.2 Management of overabundant wildlife populations causing damage to nearby inhabitants, crops and livestock. 4.3 Tools and techniques used to control problematic wildlife populations; 4.4 Human–wildlife conflict: causes, resolution and mitigation strategies; 4.5 Management of exotic and invasive species in wetlands and other habitats in India. 4.6 Habitat manipulation techniques – control and regulation of grazing, weed eradication;	

	4.7 Major diseases of domestic and wild animals and impact of wildlife tourism on conservation. 4.7 IUCN Red list of threatened species 4.8 Wildlife conservation acts	
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Recommended readings

1. Caughley, G., and Sinclair, A.R.E. (1994) Wildlife Ecology and Management. Blackwell Science.
2. Woodroffe, R., Thirgood, S. and Rabinowitz, A. (2005) People and Wildlife, Conflict or Co-existence? Cambridge University.
3. Bookhout, T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000) The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

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Subject: Zoology **Semester- V** **TYBSC NEP (2024) syllabus**
Course Code: 24ScZooU5202 **Credits: 2C (Practical)**
Course Name: Lab Course on 24ScZooU5201 Wildlife Conservation and Management

Sr. No.	Name of Practicals	No. of Practical
1.	Identification of any five terrestrial flora	
2.	Identification of any five mammalian fauna	
3.	Identification of any five avian fauna & reptiles fauna	
4.	Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses).	
5.	Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc	
6.	Demonstration of different field techniques for flora and fauna.	
7.	Study of animal community structure by quadrat method	
8.	Study of Eutrophication and its effects on freshwater ecosystem	
9.	Study of Wildlife Habitat (forest, grassland, desert, and wetland)	
10.	Study of Wildlife Protected Areas of India Using Map	
11.	Identification of animal skulls and dentition patterns to determine feeding habits (herbivore, carnivore, and omnivore).	
12.	Identification of animal fur or hair and its role in insulation and camouflage	
13.	Study of some endangered fauna and their conservation strategies	
14.	Field collection of animal signs (feathers, scat, etc.) and record keeping	
15.	Trail / transect monitoring for abundance and diversity estimation of mammals and bird(direct and indirect evidences).	
16.	Project work/Seminar on any topic related to Ecology, Environment biology, Wildlife biology, Habitat study, Animal conservation, Conservation ecology, and Environmental impact assessment	
17.	Visit to Zoological Survey of India / Museum / Wildlife Sanctuary / National Park and submission of report	

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Subject: Zoology Semester- V
Elective-1

TYBSC NEP (2024) syllabus
Credits: 2C (Theory)

Course Code: 24ScZooU5203 Course Name: Microbiology, Parasitology and Immunology

Course Objectives:

1. Understand the historical development of microbiology and core principles of host–pathogen interactions.

2. Recognize and differentiate major microbial and parasitic diseases based on causative agents, transmission modes, and pathogenesis.
3. Apply parasitological concepts to interpret zoonotic, protozoan, and helminthic infections and their adaptations.
4. Analyze the structure and function of immune system components, including antigens and antibodies.
5. Evaluate mechanisms of innate and adaptive immunity, hypersensitivity reactions, and autoimmune disorders.
6. Assess applications of immunology such as vaccines, diagnostics, immunotherapies, and pathogen immune-evasion strategies.

Course Outcomes: After successfully completing the course, the students will be able to

1. **Explain** the history of microbiology and fundamental concepts of host–pathogen interactions.
2. **Identify** and **compare** major viral, bacterial, fungal, and parasitic diseases with respect to causative agents, transmission, and pathogenesis.
3. **Apply** knowledge of parasitology to interpret zoonotic, protozoan, and helminthic infections and their adaptations.
4. **Analyze** immune system components, antigen properties, and antibody interactions.
5. **Evaluate** mechanisms of innate and acquired immunity, hypersensitivity, and autoimmune disorders.
6. **Assess** applied perspectives in immunology, including vaccines, diagnostics, immunotherapy, and immune evasion strategies.

Course Contents:

UNIT: 1	Microbiology: A brief account of pathogenic bacteria and viruses.	6 L
	• History of microbiology – germ theory, discovery of penicillin • Diversity of microbes – viruses and bacteria • Host–pathogen interactions – invasion, antigenic variation, toxins, enzymes • Viral diseases – polio, rabies (agents, pathogenesis, diagnosis, prophylaxis) • Viral diseases – hepatitis, influenza (comparative overview) • Selected bacterial diseases – <i>Salmonella typhi</i>, <i>Mycobacterium tuberculosis</i>, <i>Vibrio cholerae</i>; brief fungal infections (ringworm, aspergillosis, candidiasis)	
UNIT: 2	Parasitology: an overview of common parasitic infections.	6 L

	• Introduction to parasites – transmission, portal of entry, adaptations • Zoonotic diseases – concept and significance • Protozoan infections – amoebiasis, giardiasis • Protozoan infections – malaria (life cycle, pathogenesis, control) • Protozoan infections – trypanosomiasis, leishmaniasis, toxoplasmosis • Helminthic infections – schistosomiasis, taeniasis, echinococcosis, ascariasis, enterobiasis, dracunculiasis, filariasis	
Unit 3	Immunology: An overview of Immune mechanism and related pathways.	15 L
	• Definition and classification of immunity • Cells and organs of immune system – primary and secondary lymphoid organs • Innate immunity – first and second lines of defense • Antigen characteristics – antigenicity, immunogenicity, epitopes, haptens, adjuvants • Factors influencing immunogenicity • Structure of immunoglobulins – classes, properties, functions • Antigenic determinants – isotype, allotype, idiotype • Antigen–antibody interactions – affinity, avidity • Complement system – classical, alternative, lectin pathways • Acquired immunity – humoral and cell-mediated responses • Role of B and T cells – receptors, activation, differentiation • Cytokines – properties and functions • MHC complex – classification and function • Antigen processing and presentation • Hypersensitivity (Gell & Coombs classification) and autoimmune disorders	
Unit 4	Immunology: Integrative & Applied Perspectives	3 L
	• Case studies – host–pathogen interactions and immune evasion strategies • Applied immunology – vaccines, diagnostics, immunotherapy • Emerging infectious diseases and global health challenges	

References:

1. Jawetz, M. and Adelberg (2015) Medical Microbiology (27th edition)
2. Chatterjee, K.D (2015) Parasitology (13th edition)
3. Goldsby, R.A.; Kindt, T.J. and Kubly, J. (2006) Immunology (6th edition).
4. Roitt, I.; Brostoff, J. and Male, D. (2012) Immunology (8th edition).

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Subject: Zoology Semester- V

TYBSC NEP (2024) syllabus

Elective-1 (Practical) 2C

Course Code 24ScZooU5204 Zoology Elective Practical 1 – Lab Course on 24ScZooU5203

Practicals in Microbiology, Parasitology and Immunology

Practical (Any 15)

Sr. No.	Title	No. of Practical
1.	Preparation and sterilization of equipment	1P
2.	Types of culture media and preparation.	1P
3.	Different staining techniques in microbiology.	1P
4.	Staining and identification of Gram positive and Gram negative bacteria.	1P
5.	Kinetics of bacterial growth	1P
6.	Streak Plate Method for culturing and isolation of bacteria	1P
7.	The Spread Plate Technique for culturing and isolation of bacteria	1P
8.	Study of permanent slides and specimens of parasitic protozoans.	1P
9.	Study of permanent slides and specimens of parasitic helminthes.	1P
10.	Stages of life cycle tapeworm: <i>Taenia solium</i>	1P
11.	Study of ectoparasites of animals: lice, tick, flea, mite, bedbugs	1P
12.	Vectors of different parasitic diseases: Mosquito, House fly etc.	1P
13.	Preparation of temporary slides of gut matter by saline preparation techniques to identify parasitic protozoans and helminthes. (Cockroach)	1P
14.	ABO blood group testing principle and procedure	1P
15.	Blood: Erythrocyte Sedimentation Rate (ESR).	1P
16.	Demonstration of antigen-antibody interaction in gel.	1P

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Subject: Zoology (VSC)

Semester- V

TYBSC NEP (2024) syllabus

Elective-1 (Practical) 2C

Course Code 24ScZooU5501

Zoology Practical – Lab Course on Wildlife Biology

Course Objectives

- To master standardized field methodologies, including line transects and point counts, for the quantitative assessment of wildlife populations and habitat health.

- To utilize advanced digital tools such as GPS metadata, camera traps, acoustic analysis software, and mobile GIS for high-precision wildlife documentation and spatial ecology.
- To develop professional-grade wildlife photography and videography skills for scientific publishing, digital journalism, and independent media production.

Course Outcomes

After successfully completing this course, students will be able to:

- CO1: Execute Field Surveys: Identify local wildlife and execute standardized census techniques, including mark-recapture simulations and encounter rate calculations.
- CO2: Apply Forensic and Lab Techniques: Identify wildlife remains (hair, feathers, bone) using microscopic forensics and analyze habitat health through bioindicators.
- CO3: Utilize GIS and Remote Sensing: Generate habitat maps and analyze land-use/land-cover (LULC) changes using satellite imagery and mobile GIS tools.

(Any 15)

Sr. No	Practical Title	No. of Practical
1.	Introduction to Wildlife Biology, Scope and application	1P
2.	Digital Field practical :Geo-tagging and digital archiving of urban biodiversity using iNaturalist and Seek.	1P
3.	Wildlife Forensic Analysis : Forensics of hair, feathers, and bone remains using Foldable Microscopes for field identification.	1P
4.	Pollinator & Insect Surveys : Quantifying insect diversity in varied micro-habitats using pitfall and sweep nets.	1P
5.	Ichnology & Animal Signs : Tracking and plaster casting of scats, pugmarks, and roosting signs for habitat monitoring.	1P
6.	Avian Population Census : Executing a 10-minute bird point count method at three distinct nodes in Parks for encounter rate calculations of urban avifauna.	1P
7.	Line Transect Methodology : Density estimation of target species (butterflies/odonates) using standardized 500m transects.	1P
8.	Population Simulation : Manual Simulation & Digital Estimation of Populations	1P
9.	Ecological Data Synthesis : Statistical calculation of Shannon and Simpson diversity indices from field datasets.	1P
10.	Acoustic Bio-Soundscapes: Recording bird/frog calls and analyzing spectrograms for species-specific acoustic signatures.	1P
11.	Camera Trapping : Strategic deployment of PIR camera traps and interpretation of 48-hour behavior logs.	1P
12.	Macro Field Photography : Diagnostic photography of invertebrates/herpetofauna using macro techniques and ethical composition.	1P
13.	Wildlife Photo journalism : Managing image metadata, IPTC standards, and ethical digital asset management for publishers.	1P
14.	Wildlife of INDIA : Understanding the distribution of Indigenous species, rare, threatened and endangered species throughout INDIA.	1P
15.	Microbiology of Water Habitats : Isolating bacterial flora and identifying macroinvertebrate bioindicators in ornamental ponds.	1P
16.	Mobile GIS & Spatial Analysis : Recording GPS polygons of bird sites for professional habitat mapping.	1P

17.	Satellite Remote Sensing : LULC classification of green corridors using open-source satellite imagery.	1P
18.	Study of INDIA Forest reserve :Study of INDIAN national parks, reserves and sanctuaries.	1P
19.	Educational Scripting &Reels :Writing, shooting, and editing 60-second "Eco-Niche" vertical videos for digital platforms.	1P
20.	AI-Enhanced Storytelling : Using AI for color correction, noise reduction in field recordings, and automated species tagging.	1P
21.	Tools of Wildlife Biology : Advanced Wildlife Monitoring & Toolkit Familiarization	1P

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Subject: Zoology (Minor)

Semester- V

TYBSC NEP (2024) syllabus

Elective-1 (Practical) 2C

Course Code 24ScZooU5302

Zoology Minor Practical – Lab Course on Vector, Diseases and Control (Any 15)

Sr. no	Title	No. of Practical
1	Sampling techniques for estimation of insect population and damage	1P

2	Pest surveillance through field incidence, light traps and pheromone traps	1P
3	Pest monitoring techniques	1P
4	Study of distribution pattern of insects in crop ecosystem	1P
5	Practicable IPM practices: physical and mechanical methods	1P
6	Practicable IPM practices: cultural and biological methods	1P
7	Effect of chemical insecticide on housefly	1P
8	Effect of Biopesticide (neem) on insect pest	1P
9	Preparations of doses/ concentrations of insecticides	1P
10	Study of insect pests with respect to marks of identification, nature of damage and control measures.	1P
11	Study of types of vectors with examples	1P
12	Study of vector borne diseases and their control	1P
13	Study of disease transmitting arthropod vector, molluscan vector	1P
14	Pest control devices- pheromone trap, Knapsack sprayer, hand rotary duster	1P
15	Study of LD ₅₀ , LC ₅₀ by using mosquito/cockroach	1P
16	Mounting of mouthparts of any 5 insect pest/ vector	1P
17	Submission of mouthparts of any 5 insect pest/ vector	1P
18	Field visits to crop field/ Pharmaceutical company	1P

Level:- 5.5 (Third Year) Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
MajorCore T(2+2+2+2 or4+2+2or 4+4)P(2+2or 4)	24ScZooU6101	Ecology	2		2		20	30	50
	24ScZooU6102	Entomology	2		2		20	30	50
	24ScZooU6103	Molecular Biology	2		2		20	30	50
	24ScZooU6104	Endocrinology	2		2		20	30	50
	24ScZooU6105	LabCourseon24ScZooU6103& 24ScZooU6104		2		4	20	30	50
	24ScZooU6106	LabCourseon24ScZooU6101& 24ScZooU6102		2		4	20	30	50
Major Elective(T/P) (2+2 or 4)	24ScZooU6201	Neuroscience	2		2		20	30	50
	24ScZooU6202	LabCourseon24ScZooU6201		2		4	20	30	50
	24ScZooU6203	Biostatistics & Bioinformatics	2		2		20	30	50
	24ScZooU6204	LabCourseon24ScZooU6203		2		4	20	30	50
VSCP(2)	24ScZooU6501	Lab Course on Biotechniques		2		4	20	30	50
OJT (2)	24ScZooU6004	On Job Training		4		8	40	60	100
Total			10	12	10	24			550

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Subject: Zoology Semester- VI
Major Core Paper-12
Course Code: 24ScZooU6101

TYBSC NEP (2024) syllabus
Credits: 2C (Theory)
Course Name: Ecology

Course Objectives:

1. Understand fundamental ecological concepts and environmental processes.
2. Analyze population dynamics and community-level interactions among organisms.
3. Apply ecological principles to address and solve real-world environmental problems.
4. Evaluate patterns of biodiversity, ecological succession, and ecosystem stability.
5. Recognize and interpret major global ecological challenges and their implications.
6. Conduct basic ecological fieldwork and communicate scientific observations effectively.

Course Outcomes: After successfully completing the course, the students will be able to

1. Explain core ecological concepts and processes.
2. Analyze population growth and community interactions.
3. Apply ecological principles to real-world problems.
4. Evaluate biodiversity, succession, and ecosystem resilience.
5. Demonstrate awareness of global ecological issues.
6. Conduct fieldwork and communicate ecological findings.

Course Contents:

	Section I- Ecology	
Unit 1	Foundations of Ecology	5
	• Introduction to Ecology – scope, levels of organization • History & relevance of ecology in modern science • Ecosystem components – biotic & abiotic factors • Energy flow – food chains, food webs, trophic levels • Biogeochemical cycles – carbon, nitrogen, phosphorus, water	
Unit 2	Population Ecology	5
	• Population characteristics – size, density, distribution • Population growth models – exponential & logistic • Carrying capacity & limiting factors • Population regulation – density-dependent & independent factors • Human population ecology – demographic transition	
Unit 3	Community Ecology	5
	• Community structure – species richness & diversity indices • Ecological interactions – competition, predation, mutualism • Ecological succession – primary & secondary • Community stability & resilience • Case studies – keystone species & invasive species	
Unit 4	Ecosystem Ecology	5
	• Ecosystem productivity – GPP, NPP, efficiency • Terrestrial ecosystems – forests, grasslands, deserts • Aquatic ecosystems – freshwater & marine • Ecotones & edge effects • Applied ecosystem management – restoration ecology	
Unit 5	Global Ecology & Environmental Issues	5
	• Biomes of the world – climatic & ecological patterns • Biodiversity – values, threats, conservation strategies • Climate change – ecological impacts & adaptation • Pollution ecology – air, water, soil, noise • Sustainable development & ecological economics	
Unit 6	Applied & Advanced Ecology	5
	• Landscape ecology – spatial patterns & fragmentation • Urban ecology – cities as ecosystems • Agroecology – ecological principles in agriculture • Conservation biology – protected areas, wildlife corridors • Future of ecology – integrative approaches & global challenges	

References:

1. Colinvax, P. A. (1993) Ecology (2nd edition) Wiley, John and Sons, Inc.

2. Krebs, C. J. (2001) Ecology (6th edition) Benjamin Cummings.
3. Odum, E.P., (2008) Fundamentals of Ecology. Indian Edition. Brooks/Cole.

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Subject: Zoology Semester- VI
Major Core Paper-
Course Code: 24ScZooU6102

TYBSC NEP (2024) syllabus
Credits: 2C (Theory)
Course Name: Entomology

Course Objectives:

- To understand the origin and evolution of insects
- The understand different morphological structures of insects and their modifications
- Asses and study insect diversity by identifyingdifferent insect orders by studying their morphological characters.
- Knowledge of different phenomenon like metamorphosis, mimicry, bioluminescence and sound production

Course Outcomes: After successfully completing the course, the students will be able to

1. Aware of origin and evolution of Arthropods and insects.
2. Understand the different morphological structures of insect along with their modification.
3. Gain knowledge about major insect orders, their morphological, anatomical and behavioral peculiarities.
4. Understand insect collection and preservation techniques.

5. Understand different phenomenon like metamorphosis, bioluminescence, sound production and mimicry in insects.

Course Contents:

	Entomology	
Unit 1	Origin and Evolution in Insects	4
	1.1. Origin of Arthropoda 1.2. Ancestry of Insects 1.3. Origin of Insects 1.4. Insect Phylogeny	
Unit 2	Basic Morphology of Insects	6
	2.1. Head: Structure and types 2.2. Appendages of head: a. Antennae: Structure and types b. Compound Eyes and Ocelli c. Mouth parts: structure and modifications 2.3. Thorax structure and glands 2.4. Thoracic appendages: a. Legs: Structure and modifications b. Wings: Structure and modifications 2.5. Abdomen structure and glands 2.6. Abdominal appendages: a. Non-genital appendages b. Genital appendages	
Unit 3	Insect Diversity	12 Lectures
	3.1. General outline of classification of insects 3.2. Study of following orders with respect to distribution and taxonomy, morphological characters and with minimum two examples each: a. Order Collembola b. Order Odonata c. Order Orthoptera d. Order Isoptera e. Order Blattaria f. Order Hemiptera g. Order Coleoptera h. Order Diptera i. Order Lepidoptera j. Order Hymenoptera 3.3. Collection and Preservation of Insects	

Unit 4	Insect Metamorphosis	2
	4.1. Hatching and Post-embryonic development 4.2. Hemimetabolous and Holometabolous development	
Unit 5	Bioluminescence in Insects	2
	5.1. Structure and distribution of Luminous organs 5.2. Mechanism of Light production 5.3. Significance of Light Production 5.4. Application of Bioluminescence	
Unit 6	Sound Production in Insects	2
	6.1. Mechanisms and the sounds produced 6.2. Significance of the sounds produced 6.3. Control of sound production	
Unit 7	Mimicry in Insect	2
	7.1. Definition and concept of mimicry 7.2. Mullerian Mimicry 7.3. Batesian Mimicry 7.4. Cryptic Coloration and Camouflage	

References:

1. Chapman R.F.: The Insects-Structure and Function. ELBS Publication
2. Snodgrass R.E.: Principles of Insect Morphology
3. Richards O.W. and R.G. Davies: Imm's General Textbook of Entomology, Volume I
4. Richards O.W. and R.G. Davies: Imm's General Textbook of Entomology, Volume II
5. Gillott Cedric: Entomology
6. Romoser William S. and J.G. Stoffalono: The Science of Entomology
7. Evans H.E.: Insect Biology- A textbook of Entomology.

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Subject: Zoology Semester- VI
Major Core Paper-
Course Code: 24ScZooU6103

TYBSC NEP (2024) syllabus
Credits: 2C (Theory)
Course Name: Molecular biology

Teaching Scheme: TH: 4 Lectures/Week Total Number of Lectures: 30 Credit: 2C

Examination Scheme: CIA: 40 Marks End-Semester: 60 Marks

Course Objectives:

- To understand the structure and mutations seen in the DNA structure.
- To understand the central dogma of life.
- To get introduced to the concepts and applications of recombinant DNA technology

‘Course Outcomes:

- The student will be able to understand the flow of genetic information.
- The student will understand the difference in central dogma of prokaryotes and eukaryotes.

Unit 1	Genome Organisation	5 Lectures
	● DNA as a genetic material – Experiments evidences (Fredrick Griffith, Avery et. al, Hershey Chase experiment) ● RNA as a genetic material - TMV experiment ● Chromatin organisation – Structure and types of chromatins, packaging and remodelling of chromatin (lower order and higher order packing) histone and its effect on the packing of chromatin	
Unit 2	Central Dogma of Molecular Biology	13 Lectures

	• DNA Replication – Semiconservative replication (Messelson and Stahl experiment), Mechanism of replication in Prokaryotes and Eukaryotes • Transcription – RNA polymerase, mechanism of transcription in prokaryotes and eukaryotes, Post transcriptional modifications (Capping, tailing and splicing) • Properties of Genetic code • Translation – Ribosome structure (prokaryotes and eukaryotes), process of translation, concept of post translational modifications (glycosylation and phosphorylation)	
Unit 3	Concept of Operon	3 Lectures
	• Lac Operon – Structure, mechanism • Tryptophan operon - Structure, mechanism • Arabinose Operon - Structure, mechanism	
Unit 4	DNA Damage and Repair	4 Lectures
	• Definition and types of mutations – spontaneous, induced, somatic, gametic, forward and reverse mutations, role of mutations • Types of point mutations – transition, transversion, deletion, insertion and substitution • DNA Repair – Photo repair, Dark repair, Base excision repair	
Unit 5	Introduction to Recombinant DNA technology	5 Lectures
	• Introduction to types of enzymes used in R-DNA technology • Types of vectors, properties of hosts • Polymerase Chain Reaction (PCR) • Applications of R-DNA technology – DNA fingerprinting • Introduction to proteomics and genomics	

REFERENCES:

1. *iGenetics – A molecular approach* (2006), Peter J. Russell publishing as Benjamin Cummins Inc.
2. *Genes VIII*, 8th edition, Benjamin Lewin, John and Barlett Publishers.
3. *Molecular Biology of the Gene*, 5th edition (2004) James D. Watson, Tania Baker.
4. *Fundamentals of Molecular Biology* (2009), Pal J.K and Saroj Ghaskadbi, Oxford University Press

5. Principles of Genetic manipulation, 6th edition (2001), Primrose S. Tywman R, Blackwell Science Ltd.

PROGRESSIVE EDUCATION SOCIETY'S

**MODERN COLLEGE OF ARTS, SCIENCE AND COMMERCE (AUTONOMOUS),
SHIVAJINAGAR, PUNE- 05**

Subject - Zoology

Semester- VI

T.Y. B.Sc. Zoology syllabus

Theory- 2 Credits (30 lectures)

Course: Endocrinology

Teaching Scheme: TH: 2 Lectures/Week

Subject code – 24ScZooU6104

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

About the course:

The course envisages information on endocrine system with emphasis on the structure of hypothalamus and anterior pituitary. The associated hormones and the related disorders will be explained.

Learning outcomes: After successfully completing this course, the students will be able to:

1. Understand neurohormones and neurosecretions.
2. Learn about hypothalamo and hypophyseal axis.
3. Understand about different endocrine glands and their disorders.
4. Understand the mechanism of hormone action.

Unit 1	Introduction to Endocrinology	8 L
	1.2. Definition, scope and Principles of Endocrinology 1.3. The chemical messengers, Classification of hormones, Hormone Action. 1.2. Endocrine, paracrine and autocrine modes of hormone delivery 1.3. Feedback mechanism.	
Unit 2	Hypothalamo-hypophyseal Axis	8 L

	2.1. Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction. 2.2. Structure of hypothalamus, Hypothalamic nuclei and their functions. 2.3. Regulation of neuroendocrine glands, Feedback mechanisms. 2.4. Structure of pituitary gland, Its hormones and their functions 2.5. Hypothalamo-hypophyseal portal system. 2.6. Disorders of pituitary gland.	
Unit 3	Peripheral Endocrine Glands	8 L
	3.1. Structure, Hormones, Functions and Regulation of Thyroid gland 3.2. Parathyroid & Adrenal glands 3.3. Pancreas. 3.4. Ovary and Testis 3.5. Hormones in homeostasis. 3.6. Disorders of Peripheral endocrine glands	
Unit 4	Regulation of Hormone Action	6L
	4.1. Hormone action at Cellular level: Hormone receptors 4.2. Transduction and regulation of Hormone action at Molecular level. 4.3. Molecular mediators. 4.4. Genetic control of hormone action.	

Recommended readings:

1. Turner, C. D. (1971) General Endocrinology, Pub- Saunders Toppan.
2. Nussey, S.S.; and Whitehead, S.A. (2001) Endocrinology: An Integrated Approach, Oxford: BIOS Scientific Publishers.
3. Hadley, M.E. and Levine J.E. (2007) Endocrinology (6th edition) Pearson Prentice-Hall, New Jersey.
4. David, O.N. (2013) Vertebrate Endocrinology.
5. Guyton, A.C. and Hall, J.E. (2011) Textbook of Medical Physiology (12th edition) Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
6. Keele, C.A. & Neil, E. (1989) Samson Wright's Applied Physiology (13th edition) Oxford.
7. A Text book of General Physiology- P. H. Mistecheil.
8. General Endocrinology- Turner & Bungera.
9. A Text book of Physiology- Nagabhushnum.
10. A Text book of Physiology & Biochemistry- G. H. Bell; C. R. Paterson & E. Smith.
11. Williams Textbook of Endocrinology (15th Edition, 2025/2026)
12. Textbook of Endocrinology (1E) - Mala Dharmalingam

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Subject: Zoology **Semester- VI** **TYBSC NEP (2024) syllabus**
Course Code: 24ScZooU6105 **Credits: 2C (Practical)**
Course Name: Lab Course on 24ScZooU6101 & 24ScZooU6102

Practical (Any 15)

Sr. No.	Name of Practicals	No. of Practical
Section I- Ecology		
10.	Determination of Water Holding Capacity of Soil	1P
11.	Physical Analysis of Soil	1P
12.	Visit to Aquatic Ecosystem for Water Sampling	1P
13.	Water Quality Assessment	1P
14.	Identification of Zooplanktons from a Lake/Waterbody	1P
15.	Study of Animal Distribution Using Transects (Indirect Evidence)	1P
16.	Biodiversity Indices Calculation	1P
17.	Construction of Ecological Pyramids (Energy/Number/Biomass)	1P
18.	Behavioral Ecology – Activity Patterns of Birds/Insects	1P
19.	Soil Fauna Study (Non-Invasive Extraction)	1P
Section II- Entomology		
1.	Study of types of head, eyes and antennae	1P
2.	Study of types of legs and wings.	1P
3.	Study of external characters of a generalized insect e.g. grasshopper	1P
4.	Study of grasshopper- Temporary mounting of a. mouthparts b. antennae c. legs d. wings	1P
5.	Study of grasshopper- Temporary mounting of a. thoracic spiracle b. abdominal spiracle, c tympanum	1P
6.	Study of different insects orders (one example from each order)	2P
7.	Study of insect metamorphosis: holometabolous and hemimetabolous insects	1P
8.	Study of mimicry in insects	1P
9.	Methods of collection and preservations of insects	1P
10.	Study of some beneficial and harmful insects	1P

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Subject: Zoology

Semester- VI

TYBSC NEP (2024) syllabus

Course Code: 24ScZooU6106

Credits: 2C (Practical)

Course Name: Lab Course on 24ScZooU6103 & 24ScZooU6104

Zoology Major Practical 6 – Practicals in Molecular biology and Endocrinology

Practical (Any 15)

Sr. No.	Name of Practicals	No. of Practical
Section I- Molecular biology		
1	Isolation of Genomic DNA	1P
2	Detection of purity and absorption by Spectrophotometry	1P
2	Estimation of DNA by Diphenylamine method	1P
3	Detection of DNA and RNA by methyl green pyronin	1P
4	Preparation of DNA paper model	1P
5	Temporary preparation of Polytene chromosome from suitable material	1P
6	Separation of DNA by agarose gel electrophoresis.	1P
7	Isolation of RNA	1P
8	Demonstration of restriction digestion	1P
9	Isolation of Plasmid DNA	1P
Section II- Endocrinology		
1.	Demonstration of Endocrine System in vertebrates using animal models.(laboratory bred rat*)	1P
2.	Demonstration of Castration/ ovariectomy in laboratory bred rat*	1P
3.	Effect of adrenalin on Pulse Rate/heart rate.	1P
4.	Study of Pregnancy Diagnosis Test	1P
5.	Study of endocrine disorders by using cards/ photograph	1P
6.	Applied endocrinology-Uses of pheromone	2P
7.	Study of effect of melatonin on fish.	1P
8.	Group discussion or Seminar presentation on one or two related topics from the list	1P

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Subject: Zoology Semester- VI

TYBSC NEP (2024) syllabus

Major Core Paper-

Credits: 2C (Theory)

Course Code: 24ScZooU6201

Course Name: Neuroscience

Teaching Scheme: **2 hours/week** Total Number of Lectures: **30** Credits: **3C**

Examination Scheme: CIA: 20 Marks and End-Semester: 30 Marks

About the course

This course will start from the basics of the nervous system of invertebrates and will gradually move towards a more complex vertebrate nervous system. The students will also be taught about the types of synapse, neurotransmitters and their receptors besides other related aspects.

Course outcomes-

After successfully completing this course, the students will be able to:

1. Understanding of nervous system in Non chordates and chordates
 2. Understand the different parts structure of brain and improved methods to study it.
 3. Develop treatments for neurodegenerative diseases (such as Alzheimer's and Parkinson's diseases) and mental illnesses.
 4. Understand the structure of different lobes of the brain and their corresponding functions.
 5. Understand nerve cells and intricacies of nerve impulse conduction.
 6. Understanding of different neurotransmitter
-

Course Contents

Unit 1	Introduction to Neuroscience & Nervous System	7 L
	1.1 Origins of Neuroscience. 1.2 General organization of nervous system: Invertebrate Nervous system 1.3 Nervous system development. 1.4 organization of the Vertebrate and human central nervous system, spinal cord, 1.5 Peripheral Nervous system and Autonomous Nervous system. 1.6 Limbic System and its related functions. Learning and Memory, Neural basis of behaviour.	
Unit 2	Nerve cells and action potential	8 L
	2.1 Types of cells: neuronal, glial, ependymal and Schwann cells; 2.2 The ionic bases of resting membrane potential 2.3 The action potential- its generation and properties; The action potential conduction. 2.4 sodium-potassium pump 2.5 The action potential conduction 2.6 Action Potential & propagation- Hodgkin and Huxley's model	
Unit 3	Synaptic potential, neurotransmission	8 L

	3.1 Synapse: Synaptic transmission, Types of synapses; synaptic function; 3.2 Principles of chemical synaptic transmission; Principles of synaptic integration; EPSPs and IPSPs. Ion channels, Neural transmission. 3.4 Synaptic plasticity- Hebbian Theory 3.5 Neurotransmitters- Different types- catecholamines, amino acidergic and peptidergic neurotransmitters 3.6 Agonist and antagonist for neurotransmitters: Acetylcholine, Dopamine, GABA and Glutamate	
Unit 4	Neuropharmacology and molecular pathogenesis	7 L
	4.1 Relationship of functional properties of neural systems with perception and behavior. 4.2 molecular basis of behaviour including learning and memory 4.3 Neuropharmacology: Introduction and its branches. 4.4 Molecular pathogenesis of pain and neurodegenerative diseases such as Parkinson's, Alzheimer's, psychological disorders, Addiction. 4.5 Behavioural neuropharmacology: Effects of drug dependence and addiction.	

Reference Books:

1. Baer, M.F. and Connors B.W. (2015) Neuroscience: Exploring the brain. 3rded
2. Byrne, J.H.; Heidelberg, R. and Waxham, M.N. (2014) From Molecules to Networks: An Introduction to Cellular and Molecular Neuroscience.
3. Kandel, E.R.; Schwartz, J.H. and Jessell, T.M. (2000) Principles of Neural Science (4th edition) McGraw Hill Companies
4. Simmons, J. and Young, D. (2003) Nerve Cells and Animal Behaviour (2nd edition) Peter. CUP.
5. Stahl, S.M. (2000) Essential Psychopharmacology- Neuroscientific Basis and Practical Applications (2nd edition) CUP
6. Vilayanur, S.R. and Blakeslee S. (1998) Phantoms in the Brain. Probing the Mysteries of the Human Mind
6. Sanes D, et al (2005) Development of Nervous System 2nd ed. Academic Press
7. Johnston and Wu (1994), Foundation of Neurophysiology
8. Ralph Grenspan (2007), An Introduction to Nervous System.
9. Gerstner and Kistler (2002), Spiking Neuron Models

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Subject: Zoology

Semester- VI

TYBSC NEP (2024) syllabus

Course Code: 24ScZoo6202

Credits: 2C (Practical)

Course Name: Lab Course on Lab Course on 24ScZooU6201

Course Name: Neuroscience

Teaching Scheme: 2 hours/week Total Number of Lectures: 30 Credits: 3C

Examination Scheme: CIA: 20 Marks and End-Semester: 30 Marks

Sr. No.	Name of Practicals	No. of Practical
1.	Dissection and study of Drosophila nervous system using GFP reporter	1P
2.	Observation and counting of Drosophila photoreceptor neurons in healthy and diseased condition.	1P
3.	Study of cockroach Nervous system	1P
4.	Dissection of Fish brain	1P
5.	Nerve Cell preparation from the spinal cord	1P
6.	Study of neurons and/ or myelin by Nissl, Giemsa or Luxol Fast Blue staining.	1P
7.	Study of olfaction in Drosophila	1P
8.	Rodent brain histology	1P
9.	Study of novelty, anxiety and spatial learning in mice.	1P
10.	Group discussion or Seminar presentation on one or two related topics from the list	1P

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Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

Subject: Zoology Semester- VI

TYBSC NEP (2024) syllabus

Elective -III**Course Code: 24ScZooU6203****Credits: 2C (Theory)****Course Name: Biostatistics and Bioinformatics****Course Objectives:**

1. Understand methods of collecting, organizing, and graphically presenting biological data.
2. Apply statistical measures such as central tendency, dispersion, correlation, and regression in biological research.
3. Analyze probability distributions and statistical tests to interpret experimental outcomes.
4. Describe the fundamentals of bioinformatics, information technology, and biological data-storage systems.
5. Evaluate major biological databases and sequence analysis tools used in genomics, proteomics, and biodiversity studies.
6. Integrate biostatistical and bioinformatics approaches to solve problems in health, pharmacology, and ecology.

Course Outcomes: After successfully completing the course, the students will be able to

1. **Explain** methods of data collection, classification, and graphical presentation.
2. **Apply** measures of central tendency, dispersion, correlation, and regression to biological data.
3. **Analyze** probability distributions and statistical tests to interpret experimental results.
4. **Describe** the scope of bioinformatics and basics of IT, including data archiving and retrieval systems.
5. **Evaluate** biological databases and sequence analysis tools for genomic, proteomic, and biodiversity studies.
6. **Integrate** biostatistical and bioinformatics approaches to solve problems in clinical, pharmacological, and ecological contexts.

Course Contents:

UNIT: 1	Data Collection & Presentation	4 L
	• Introduction to biostatistics – scope and applications • Collection and classification of data • Graphical representation – pie chart, bar diagram, histogram • Frequency polygon, cumulative frequency curve (Ogive), box plot	
UNIT: 2	Measures & Distributions	5 L
	• Measures of central tendency – mean, median, mode • Measures of dispersion – variance, standard deviation, standard error • Coefficient of variation – concept and applications • Probability basics – rules, conditional probability • Probability distributions – binomial, Poisson, normal distribution	

Unit 3	Correlation, Regression & Inference	6 L
	- Correlation – types, calculation in continuous and ordinal data - Regression – linear regression, regression coefficient - Sampling methods and sampling distribution - Hypothesis testing – null and alternative hypotheses - Parametric tests – t-test, ANOVA; Non-parametric tests – chi-square - Applications in biology – epidemiology, clinical trials, experimental design	
Unit 4	Basics of IT & Data Archiving	4 L
	- Introduction to bioinformatics – scope, digital laboratory concept - Basics of IT – computers, operating systems, networks - Internet protocols – TCP/IP, hypertext, web pages, URLs - Data archiving systems – FASTA format, accession numbers, GI numbers	
Unit 5	Databases & Retrieval Systems	5 L
	- Nucleic acid sequence databases - Genome databases - Protein sequence, structure, and interaction databases - Literature databases and biodiversity/ecosystem databases - Data retrieval systems – Entrez, SRS, PIR, search engines	
Unit 6	Sequence Analysis & Applications	6 L
	- Sequence analysis tools – motifs, folds, domains prediction - Sequence alignments – BLAST, Clustal W - Phylogenetic tree construction – PHYLIP and related tools - Functional genomics – transcriptomics, proteomics - Applications – clinical informatics, cheminformatics, pharmacoinformatics - Future directions – AI in bioinformatics, big data challenges	

References:

1. Daniel, W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences (10th edition) John Wiley.
2. Milton, J.S. & Tsokos, J.O. (1992) Statistical Methods in the Biological and Health Sciences (2nd edition) McGraw Hill.
3. Zar, J.H. (2013) Biostatistical Analysis (5th edition) Pearson.
4. Barnes, M.R. and Gray, I.C. (2003) Bioinformatics for geneticists, Wiley.
5. Mount, D.W. (2006) Bioinformatics (2nd edition) CBS.

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Subject: Zoology

Semester- VI

TYBSC NEP (2024) syllabus

Course Code: 24ScZoo6204

Credits: 2C (Practical)

Course Name: Lab Course on 24ScZooU6203

Teaching Scheme: 2 hours/week Total Number of Lectures: 30 Credits: 3C

Examination Scheme: CIA: 20 Marks and End-Semester: 30 Marks

Zoology Elective Practical 3 – Practicals in Biostatistics and Bioinformatics

Practical (Any 15)

Sr. No.	Title	No. of Practical
1.	Collection and Classification of Data	1P
2.	Tabulation of Data	1P
3.	Graphical Representation of Data	1P
4.	Frequency Polygon and Ogive	2P
5.	Box Plot Construction	2P
6.	Measures of Central Tendency	1P
7.	Measures of Dispersion	1P
8.	Correlation and Regression Analysis	1P
9.	Introduction to Biological Databases	1P
10.	Data Archiving Systems	1P
11.	Basics of IT for Bioinformatics	1P
12.	Sequence retrieval from databases (ENTREZ)	1P
13.	Protein Identification Resource (PIR)	1P
14.	Literature Databases	1P
15.	Sequence Alignment (BLAST and Clustal W)	1P
16.	Phylogenetic Tree Construction (PHYLIP/Online Tools)	1P

Subject: Zoology (VSC)

Semester- VI

TYBSC NEP (2024) syllabus

Course Code: 24ScZooU6501

Credits: 2C

(Practical) Course Name: Lab Course on Biotechniques

Examination Scheme: CIA: 20 Marks and

End-Semester: 30 Marks

Sr. No.	Title	No. of Practical
	Biological Techniques (Any 4)	
1.	Preparation of buffer and measurement of pH using different samples (E)	1P
2.	Separation of Amino acids by Paper Chromatography (E)	1P
3.	Tissue collection, fixation and Infiltration (E)	1P
4.	Study of Block making and Section cutting (E)	1P
5.	Sectioning, staining & mounting. Submission of any two permanent slides from different organs (E)	1P
6.	Study of Feulgen technique (E)	1P
7.	Cell/ Tissue culture laboratory design, equipments (D)	1P
8.	Study of cell culture media (D)	1P
9.	Cell counting by Haemocytometer (E)	1P
10.	Primary cell culture of chick embryo fibroblast (E)	1P
11.	Study of Agarose gel electrophoresis (E)	1P
12.	Study of Southern blotting (D)	1P
13.	Study of Principle and working of Spectrophotometer (E)	1P
14.	Study of Principle and working of centrifugation (E)	1P
15.	Study of Blood film (E)	1P
16.	Visit to Tissue culture laboratory/Institute	1P