



SIR P. T. SARVAJANIK COLLEGE OF SCIENCE, (AUTONOMOUS) ATHWALINES,
SURAT-395001



Sir P. T. Sarvajani College of Science
(Autonomous)

Affiliated to Veer Narmad South Gujarat University,
Surat

Re-Accredited 'A⁺' with CGPA 3.35

SYLLABUS
FOR
SEM V
Program: B. Sc.
Course: ZOOLOGY

For
Academic year
2026-27
(NEP-2020)
Effective from June 2026-27



Board of Studies in Zoology

Undergraduate and Post Graduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Dr. Jaya Patel	Chairperson	Sir P. T. Sarvajani College of Science
Two experts from other than the parent University			
1	Dr. Nikunj Bhatt	Associate Professor	Department of Zoology, V. P. & R. P. T. P. Science College, (Autonomous), Vallabh Vidyanagar, Anand
2	Dr. Amol Patwardhan	Assistant Professor	K. J. Somaiya College of Science and Commerce (Autonomous), Mumbai
Subject Expert nominated by Vice-Chancellor			
1	Dr. Krupal Patel	Assistant Professor	Department of Zoology, Govt. Arts, Commerce & Science College, Limbayat, Surat
Meritorious Alumnus			
1	Mr. Bhavesh Chevli	Chief of Manufacturing	Envision Scientific Pvt. Ltd Sachin-Hazira Road
Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, to be nominated by the Principal.			
1	Dr. Arun Dholakia	Retd. Associate Professor	Department of Zoology, Sir P. T. Sarvajani College of Science, Surat
Representative from Industry/corporate sector/allied area			
1	Ms. Pinal Patel	Board of Member	TINSA, Ecological Foundation Bhopal, Madhya Pradesh
Faculty of the specialization			
1	Dr. Jaya Patel	Associate Professor & Head	Sir P. T. Sarvajani College of Science
2	Dr. Nitin Solanki	Assistant Professor	Sir P. T. Sarvajani College of Science
3	Dr. Neelam Mishra	Adhyapak Sahayak	Sir P. T. Sarvajani College of Science



Content

Sr. No	Semester	Course number	Course Code	Course Title
Core Course (CC)				
1	V	CC XI	ZOOMJ-S5P11-2CR26	Non Chordates and Chordates-IV
2		CC XII	ZOOMJ-S5P12-2CR26	Biochemistry
3		CC XIII	ZOOMJ-S5P13-2CR26	Forensic Science and Toxicology
4		CC MJ Practical IX	ZOOMJ-S5PR9-2CR26	Zoology Practical-IX
5		CC MJ Practical X	ZOOMJ-S5PR10-2CR26	Zoology Practical-X
6		CC MJ Practical XI	ZOOMJ-S5PR11-2CR26	Zoology Practical-XI
7		CC MN IV	ZOOMN-S5P4-2CR26	Tissue System-II and Molecular Biology
8		CC MN V	ZOOMN-S5P5-2CR26	Non Chordates and Chordates
9		MN Practical IV	ZOOMN-S5PR4-2CR26	Zoology Minor Practical-IV
10		MN Practical V	ZOOMN-S5PR5-2CR26	Zoology Minor Practical-V
11		SEC IV	SEC-S5P1-2CR26	Research Methodology and Scientific Communication



Detailed B. Sc. Zoology Syllabus

T. Y. B. Sc. Syllabus with effect from the Academic year 2025-26

Course No.	Course Title	Course Code	Credits	Hour	Module	Lectures per module (1 Hr)	Examination		
							Internal Marks	External Marks	Total Marks
SEMESTER V									
Major Courses Theory and Practical									
CC XI	Non Chordates and Chordates-IV	ZOOMJ-S5P11-2CR26	2	30	2	15	25	25	50
CC IX	CC MJ Practical IX	ZOOMJ-S5PR9-2CR26	2	60	-	-	25	25	50
CC XII	Biochemistry	ZOOMJ-S5P12-2CR26	2	30	2	15	25	25	50
CC X Practical	CC MJ Practical X	ZOOMJ-S5PR10-2CR26	2	60	-	-	25	25	50
CC XIII	Forensic Science and Toxicology	ZOOMJ-S5P13-CR26	2	30	2	15	25	25	50
CC XI Practical	CC MJ Practical XI	ZOOMJ-S5PR11-CR26	2	60	-	-	25	25	50
CC MN IV	Tissue System II and Molecular Biology	ZOOMN-S5P4-2CR26	2	30	2	15	25	25	50
MN Practical IV	Zoology Minor Practical-IV	ZOOMN-S5PR4-2CR26	2	60	-	-	25	25	50
CC MN V	Non Chordates and Chordates	ZOOMN-S5P5-2CR26	2	30	2	15	25	25	50
MN Practical V	Zoology Minor Practical-V	ZOOMN-S5PR5-2CR26	2	60	-	-	25	25	50



T. Y. B. Sc. (Zoology)
SEMESTER - V
Course Name: Non Chordates and Chordates - IV
Course Code: ZOOMJ-S5P11-2CR26
Theory [Credits -02]

Course learning outcome		
After successfully completing this course student will be able to: Classify different Non– Chordates phyla and Classification of Chordates up to orders with suitable examples and reasons		
Module1	Non– Chordates	[15L]
Learning Objective - Students know and understand taxonomy of Non– chordates up to orders - Students can explain salient features of invertebrate and vertebrate animals - Students will understand different system of Scorpion		
Learning Outcomes: - Students can classify protozoa, porifera and cnidaria upto orders with reasons - Students will understand the evolutionary trends among lower animals. - Students will be Identify protozoans up to order level based on movement and lifestyle. - Students will identify porifera based on spicule composition and body organization. - Students are able to classify cnidarians based on body form, symmetry, and polyp/medusa dominance.		



Students will understand different system of scorpion like Respiratory system, Excretory system, Nervous system and Sense Organs		
1.1	Classification of Non- Chordates phyla up to orders - Protozoa - Porifera - Cnidaria	
1.2	Study of following animal types with reference to the Structure and functions of various organs of all systems study: Scorpion - External features - Digestive system - Blood Vascular system - Respiratory system - Excretory system - Nervous system and Sense Organs - Reproductive system, Copulation, Fertilisation and Development.	
Module2	Chordates	[15L]
Learning Objective - Students know and understand taxonomy of chordates up to orders - Students know taxonomic status of chordates organisms - Students can explain salient features of vertebrate animals - Student explain chordates examples with its salient features		
Learning Outcomes: - Students will understand and classify different class of vertebrate up to orders - Students will know different characters between different classes of chordates - Explain chordates examples with its salient features - Students can distinguish vertebrate orders with examples - Know different between chondrichthyes and oestichthyes - Understand salient features of Amphibia, Reptile, Aves and Mammal		
2.1	Classification of Chordates up to orders: - Protochordates - Cyclostomata - Pisces - Amphibia - Reptile - Aves - Mammal	



References:

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2. A Text book of Zoology Invertebrates, Vol. I 1992, 7th Edn. Parker and Haswell edited by Marshall William, C B S publishers and distributors, New Delhi.
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5. A text book of Zoology, Vol.II, 1990, T. J. Parker and W. A. Haswell, Low price Publication, Delhi. Modern Text Book of Zoology, 1992, R. L. Kotpal, Rastogi Publication, Meerut.
6. An Introduction to Protochordata, 1990, H. S. Bhamrah and Kavita Juneja, Anmol publication, New Delhi.
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32. Text Book of Chordates - A. Thangamani, S. Prasanna Kumar
33. Text Book of Zoology - Dalela and Verma. Jay Prash Nath & co. Meeru
34. Text book of Zoology - R. D. Vidyarthi. S. Chand
35. Text Book of Zoology - S.N. Prasad. Vikas Publishing House pvt. ltd. Delhi
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Mapping of COs and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Classify different Non- Chordates phyla	X	X				
Know the different system of scorpion		X				



Classify of Chordates up to orders	X	X				
Understand salient features of Non- Chordates organisms		X				
Understand salient features of chordates organisms		X				

Unit	Remembering (1)	Understanding (2)	Applying (3)	Analyzing (4)	Evaluating (5)	Creating (6)	Total
I	30%	70%	-	-	-	-	100%
II	30%	70%	-	-	-	-	100%

**T. Y. B. Sc.
SEMESTER - V
Course Name: Non Chordates and Chordates - IV
Course Code: ZOOMJ-S5PR9-2CR26
Practical [Credits -02]**

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

- Classify invertebrate and vertebrate animals up to orders
- Know different organisms with its features and class
- Taxonomic status of non-chordates and chordates organisms
- Identify organisms with characteristics

The following practical are to be studied with the help of charts, models, videos, photographs, permanent slides, working models, etc.

1	Classification of following animals up to orders: Protozoa: Trypanosoma, Monocystis, Vorticella
2	Classification of following animals up to orders: Porifera: Grantia, Euplectella, Spongilla
3	Classification of following animals up to orders: Cnidaria: Hydra, Cyanea, Gorgonia
4	Classification of following animals up to orders: Protochordates: Ascidia, Amphioxus, Salpa, Doliolum
5	Classification of following animals up to orders: Cyclostomata: Lamorey, Myxine



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6	Classification of following animals up to orders: Pisces: Electric ray, Sting ray, Scoliodon, Hammer headed shark, Pristis, Labeo, Mrigal, Ophiocephalus, Flat fish, Scorpion fish, Bombay duck, Pipe fish.
7	Classification of following animals up to orders: Amphibia: Ichthyophis, Salamander, Frog, Pipa, Tree frog.
8	Classification of following animals up to orders: Reptile: Turtle, Calotes, Cobra, Dhaman, Python, Krait
9	Classification of following animals up to orders: Aves: Archaeopteryx, Pigeon, Owl, Sparrow, Kite, Pelican
10	Classification of following animals up to orders: Mammal: Duck billed platypus, Kangaroo, Monkey, Mongoose, Squirrel, Rabbit, Deer
11	External characters and Digestive system of Scorpion
12	Blood Vascular system of Scorpion
13	Respiratory system of Scorpion
14	Excretory system of Scorpion
15	Nervous system and sense organs of Scorpion
16	Reproductive system of Scorpion

Mapping of COs and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Classify different Non– Chordates phyla	X	X				
Know and draw different system of scorpion		X	X			
Classify of Chordates up to orders	X	X				
Understand salient features of Non– Chordates organisms		X				
Understand salient features of chordates organisms		X				



T. Y. B. Sc.
SEMESTER V
Course Name: Biochemistry
Course Code: ZOOMJ-S5P12-2CR26
Theory [Credits - 02]

Course learning outcome

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

- Explain and analyze metabolic pathways including carbohydrate, lipid, and amino acid metabolism, along with their regulation and energy yield.
- Apply principles of biological thermodynamics to interpret energy transformations, thermodynamic laws, and functions such as Gibbs free energy, entropy, and enthalpy in living systems.
- Describe structure, classification, and mechanism of enzyme action.
- Analyze enzyme kinetics, factors affecting enzyme activity, and types of enzyme inhibition with applications.

Module 1	Metabolism, Biological Thermodynamics, and Bioenergetics	[15L]
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Learning Objective:

- Comprehend and analyze metabolic pathways and their regulatory mechanisms in biological systems.
- Evaluate and interpret thermodynamic principles governing energy transformations, including bioenergetics and thermodynamic functions.

Learning Outcomes:

- Analyze metabolic pathways and their regulatory mechanisms in biological systems.
- Evaluate energy dynamics and bioenergetic processes associated with metabolism.
- Interpret thermodynamic laws and their implications in biological systems.
- Apply concepts of Gibbs free energy, entropy, and enthalpy to biochemical reactions.

1.1	Metabolism: 1.1.1 Carbohydrate Metabolism: Gluconeogenesis 1.1.2 Lipid Metabolism: β -Oxidation of Fatty Acids • Saturated fatty acids with even number of carbon atoms • Saturated fatty acids with odd number of carbon atoms 1.1.3 ω -Oxidation of Fatty Acids 1.1.4 Biosynthesis of Palmitic Acid 1.1.5 Amino Acid Catabolism: Transamination, Deamination, Urea Cycle	
1.2	1.2.1 Biological Thermodynamics: Introduction to Thermodynamics 1.2.2 Laws of Thermodynamics • Zeroth Law of Thermodynamics	



	- First Law of Thermodynamics: Implications in biological systems - Second Law of Thermodynamics: Significance in biological systems - Concept of Third Law of Thermodynamics 1.2.3 Thermodynamic Processes: Isothermal process & Adiabatic process 1.2.4 Heat and Energy Concepts: Concept of heat of a reaction & Concept of work and energy 1.2.4 Energy Changes in Biochemical Reactions: Endergonic reactions, Exergonic reactions & Energy transformation in biological systems 1.2.6 Thermodynamic Functions: Total internal energy 1.2.7 Gibbs Free Energy 1.2.8 Entropy 1.2.9 Enthalpy	
Module 2	Enzyme	[15L]
Learning Objective - Understand enzyme structure and function. - Explain enzyme kinetics and inhibition.		
Learning Outcomes: - Analyze enzyme structure, classification, and mechanisms of action. - Evaluate enzyme kinetics and interpret parameters such as K_m and V_{max}. - Differentiate types of enzyme inhibition and their kinetic effects. - Apply knowledge of enzymes in medical, industrial, and biotechnological contexts.		
2.1	2.1 Introduction to Enzymes - Definition and characteristics of enzymes - Holoenzyme, Apoenzyme and Prosthetic group 2.1.2 Interaction Between Enzyme and Substrate - Lock and key model - Induced fit model 2.1.3 Enzyme Commission (EC) System of Classification - Basis of IUBMB classification 2.1.4 Nomenclature of Enzymes - Enzyme class, subclass and sub-subclass - One suitable example	
2.2	2.2 Enzyme Kinetics 2.2.1 Factors Affecting Velocity of Enzyme-Catalyzed Reactions - Effect of enzyme concentration - Effect of substrate concentration - Effect of temperature - Effect of pH - Effect of inhibitors - Effect of activators - Graphical representation of above factors	



2.3	Michaelis–Menten Kinetics • Derivation of Michaelis–Menten equation • Michaelis constant (K_m) – definition and significance • Maximum velocity (V_{max}) – definition and significance • Lineweaver–Burk plot 2.3.1 Enzyme Inhibition • Reversible inhibition – examples • Irreversible inhibition – examples 2.3.2 Types of Reversible Inhibition • Competitive inhibition • Non-competitive inhibition • Uncompetitive inhibition • Graphical determination of type of inhibition
2.4	2.4.1 Applications of Enzymes • Medical and clinical applications • Industrial applications • Food and biotechnology applications
References: 1. Naik, P. (2012). <i>Biochemistry</i>. 2. Sawhney, S. K., & Singh, R. (2005). <i>Introductory Practical Biochemistry</i>. 3. Chakrapani, U., & Satyanarayana, U. (2014). <i>Biochemistry</i>. 4. Weil, J. H. (2002). <i>General Biochemistry</i>. 5. Jain, J. L., Jain, S., & Jain, N. (2012). <i>Fundamentals of Biochemistry</i>. 6. Gurr, M. I., & Harwood, J. L. (1991). <i>Lipid Biochemistry</i>. 7. Walker, J. M., & Wilson, K. (2005). <i>Practical Biochemistry: Principles and Techniques</i>. 8. Granner, D. K., Murray, R. K., & Rodwell, V. W. (2015). <i>Harper's Illustrated Biochemistry</i>. 9. Okotore, R. O. (2012). <i>Basic Separation Techniques in Biochemistry</i>. 10. Elliott, D. C., & Elliott, W. H. (2005). <i>Biochemistry and Molecular Biology</i>. 11. Verma, V., & Verma, S. (2010). <i>Textbook of Plant Physiology</i>. 12. Agarwal, R. A., & Kumar, K. (2010). <i>Animal Physiology and Biochemistry</i>. 13. Sastry, K. V. (2012). <i>Animal Physiology and Biochemistry</i>. 14. Chakraborty, C. (2013). <i>Advanced Biochemistry and Biotechnology</i>. 15. Yadav, N. (2014). <i>Biochemistry and Biotechnology</i>. 16. Rao, B. P. (2008). <i>Viva Voce in Biochemistry</i>. 17. Berry, A. K. (2011). <i>Textbook of Biochemistry for Undergraduate Students</i>. 18. Bennett, T. P. (2008). <i>Modern Topics in Biochemistry</i>. 19. Conn, E. E., & Stumpf, P. K. (1987). <i>Outline of Biochemistry</i>. 20. Edelstein, S. J. (1988). <i>Introductory Biochemistry</i>. 21. Karlson, P. (1994). <i>Introduction to Modern Biochemistry</i>. 22. Arora, M. (2013). <i>Biochemistry</i>. 23. Singh, S. (2012). <i>Textbook of Enzymes</i>.	



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Mapping of COs and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Analyze metabolic pathways and their regulatory mechanisms in biological systems.			X			
Evaluate energy dynamics and bioenergetic processes associated with metabolism.			X			
Interpret thermodynamic laws and their implications in biological systems.			X			
Apply concepts of Gibbs free energy, entropy, and enthalpy to biochemical reactions		X				
Analyze enzyme structure, classification, and mechanisms of action.			X			
Evaluate enzyme kinetics and interpret parameters such as K_m and V_{max} .			X			
Differentiate types of enzyme inhibition and their kinetic effects.		X	X			
Apply knowledge of enzymes in medical, industrial, and biotechnological contexts.			X			



Unit	Remembering (1)	Understanding (2)	Applying (3)	Analyzing (4)	Evaluating (5)	Creating (6)	Total
I	20%	50%	30%	-	-	-	100%
II	20%	50%	30%	-	-	-	100%

T. Y. B. Sc.

SEMESTER V

Course Name: Biochemistry

Course Code: ZOOMJ-S5PR10-2CR26

Theory [Credits - 02]

Course learning outcome

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

- Perform qualitative tests to identify major biomolecules such as carbohydrates, lipids, proteins, and amino acids.
- Demonstrate experimental skills in studying enzyme activity using suitable laboratory techniques.
- Analyze the effect of different factors (substrate concentration, temperature, pH, inhibitors) on enzyme activity.
- Interpret experimental observations and represent data using graphs and charts.
- Classify and identify enzymes based on their reactions and understand their biological significance.
- Develop basic laboratory skills, safety practices, and proper handling of reagents and instruments.

Practical Module (ZOOMJ-S5PR10-2CR26)

[60L]

The following practical are to be taught / studied only with the help of charts, models, videos, photographs, permanent slides, working models etc.

1	Practical 1: Qualitative Tests for Carbohydrates Aim: To detect the presence of carbohydrates in given samples. Principle: Carbohydrates react with specific reagents to give characteristic colour changes. Tests: • Molisch's test • Benedict's test • Fehling's test • Iodine test (starch)
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	Result: Presence or absence of carbohydrates confirmed. Practical 2: Qualitative Tests for Lipids Aim: To identify lipids in the given sample. Principle: Lipids show characteristic solubility and staining properties. Tests: • Grease spot test • Sudan III / Sudan IV test • Solubility test Result: Confirmation of lipid presence. Practical 3: Qualitative Tests for Amino Acids / Proteins Aim: To detect amino acids and proteins. Principle: Proteins react with specific reagents forming coloured complexes. Tests: • Biuret test • Ninhydrin test • Xanthoproteic test • Millon's test Practical 4: Study of Enzyme Action (Salivary Amylase) Aim: To study the action of salivary amylase on starch. Principle: Amylase hydrolyses starch into maltose. Test Used: Iodine test for starch disappearance. Practical 5: Effect of Substrate Concentration on Enzyme Activity Aim: To study the effect of substrate concentration on enzyme velocity. Principle: Reaction rate increases with substrate concentration until V_{max} is reached. Graph: Velocity vs Substrate concentration. Practical 6: Effect of Temperature on Enzyme Activity Aim: To determine optimum temperature of an enzyme. Observation: Activity increases up to optimum temperature, then decreases. Graph: Enzyme activity vs Temperature. Practical 7: Effect of pH on Enzyme Activity Aim: To study the effect of pH on enzyme action. Observation: Each enzyme has a specific optimum pH. Graph: Enzyme activity vs pH. Practical 8: Effect of Enzyme Inhibitors Aim: To study enzyme inhibition. Types Studied: • Competitive inhibition • Non-competitive inhibition (demonstration) Graphical Interpretation: Lineweaver–Burk plots (theoretical / model based).	
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	Practical 9: Identification of Enzymes (Spotting) Aim: To identify enzymes based on given reactions or charts. Includes: • Enzyme class • Substrate • Product • EC classification (theoretical) Practical No. 10: Protein Estimation by Lowry's Method Aim: To estimate the concentration of protein using Lowry's method.	

Mapping of COs and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Perform qualitative tests to identify major biomolecules such as carbohydrates, lipids, proteins, and amino acids.	X					
Demonstrate experimental skills in studying enzyme activity using suitable laboratory techniques.	X					
Analyze the effect of different factors (substrate concentration, temperature, pH, inhibitors) on enzyme activity.		X				
Interpret experimental observations and represent data using graphs and charts.	X					
Classify and identify enzymes based on their reactions and understand their biological significance.	X					
Develop basic laboratory skills, safety practices, and proper handling of reagents and instruments.	X					
Perform qualitative tests to identify major biomolecules such as carbohydrates, lipids, proteins, and amino acids.		X				
Demonstrate experimental skills in studying enzyme activity using suitable laboratory techniques.		X				
Analyze the effect of different factors (substrate concentration, temperature, pH, inhibitors) on enzyme activity.	X		X			
Interpret experimental observations and represent data using graphs and charts.	X		X			
Classify and identify enzymes based on their reactions and understand their biological significance.		X				
Develop basic laboratory skills, safety practices, and proper handling of reagents and instruments.			X			



Perform qualitative tests to identify major biomolecules such as carbohydrates, lipids, proteins, and amino acids.			X			
Demonstrate experimental skills in studying enzyme activity using suitable laboratory techniques.		X	X			

T. Y. B. Sc.

SEMESTER V

Course Name: Forensic Science and Toxicology

Course Code: ZOOMJ-S5P13-2CR26

Theory [Credits - 02]

Course learning outcome		
After successfully completing this course, students will be able to:		
- To provide a foundational understanding of the history, scope, and legal evolution of forensic science. - To introduce the core scientific principles and "laws" that govern forensic investigations. - To introduce modern technological advancements including AI, Nanotechnology and Genomics in criminalistics.		
Module1	Forensic science	[15L]
Learning Objective: - To provide a foundational understanding of the history, scope, and legal evolution of forensic science. - To introduce the core scientific principles and "laws" that govern forensic investigations. - To introduce modern technological advancements including AI, Nanotechnology and Genomics in criminalistics.		
Learning Outcomes: - Explain the historical evolution of forensic science and its role in the modern justice system. - Apply the Seven Fundamental Laws of Forensic Science to hypothetical crime scenes, specifically demonstrating how Locard's Exchange Principle governs trace evidence recovery. - Differentiate between the Law of Probability and the Law of Circumstantial Facts in the context of judicial evidence.		
1.1	Introduction, scope, historical aspects and development.	
1.2	Fundamental principles of forensic science: Locard's Exchange Principle, Law of Individuality, Law of Progressive Change, Law of Analysis, Law of Probability, Law of Circumstantial Facts	
1.3	Advancements in Forensic science: Artificial Intelligence and Machine learning in Forensic science, Forensic Genomics, Nanotechnology in Forensics	
1.4	Identification: dactylography, foot prints, tattoo marks, occupational marks and DNA fingerprinting.	
1.5	Wildlife forensics: Morphology and biochemistry of human hair, comparison of human and animal hair, identification of pug marks of various animals.	



Module2	Toxicology	[15L]
Learning Objective - Analyze the toxicokinetics of alcohol (Ethanol, Methanol, Isopropanol) and glycol-based substances. - Identify the symptoms and clinical manifestations of poisoning by narcotics (Opium), sedatives (Barbiturates), and volatile solvents (Chloroform, Ether). - Distinguish between various hydrocarbon poisonings, such as Naphthalene and Turpentine		
Learning Outcomes: - To introduce the history, scope, and various disciplines of toxicology and the classification of toxicants. - To detail the pharmacological and toxicological effects of CNS depressants and volatile hydrocarbons. - To explore the mechanisms, symptoms, and nature of venoms and stings from various fauna (Biotoxicology). - To examine the role of food additives, the risks of food contaminants (molds/mycotoxins), and the protocols for safety testing.		
2.1	Introduction, History, Scope, Disciplines of Toxicology, Toxicants and their Classification	
2.2	Forensic toxicology: CNS Depressants - Alcohol, Methyl Alcohol, Ethylene glycol, Isopropanol, Chloroform, Ether, Opium, Barbiturates, Chloral hydrate, Paraldehyde, Hydrocarbons, Turpentine, Naphthalene	
2.3	Biotoxicology: Venom and poison, Snake venom, Scorpion sting, Bee and Wasp stings, Spider bite	
2.4	Food-Additives: General account, incidental(indirect) additives, intentional(direct) additives	
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T. Y. B. Sc.

SEMESTER V

Course Name: Forensic Science and Toxicology

Course Code: ZOOMJ-S5PR11-2CR26

Practical [Credits - 02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

- To provide a foundational understanding of the history, scope, and legal evolution of forensic science.
- To introduce the core scientific principles and "laws" that govern forensic investigations.

Practical Module-I (ZOOMJ-S5PR11-2CR25)

[60L]

The following practical are to be studied with the help of charts, models, videos, photographs, permanent slides, working models, etc.

1	To study different types of finger prints.	
2	To develop, visualize, and lift latent fingerprints from various non-porous and semi-porous surfaces using fingerprint powder and lifting tape for identification purposes.	
3	To study different types of tattoo marks in human.	
4	To study different types of occupational marks in human.	
5	To study the morphology of different hairs - man, dog, horse, cow, buffalo and goat.	
6	To study different bite marks and sting marks.	
7	Study of various samples of food additives/preservatives and their usages. (vinegar, benzoic acid, formic acid, citric acid, gelatin)	
8	Detection of coloring substances in red chilli and turmeric powder.	
9	Detection of adulteration in ghee and paneer.	
10	Detection of copper sulphate or malachite green solution on surface of green vegetables.	
11	To perform a systematic investigation of a simulated (artificial) crime scene by identifying, documenting, and collecting physical evidence.	
12	To study the DNA fingerprinting.	



T. Y. B. Sc.

SEMESTER V

Course Name: Tissue System - II and Molecular Biology

Course Code: ZOOMN-S5P4-2CR26

Theory [Credits - 02]

Course learning outcome		
After successfully completing this course, students will be able to:		
- Analyze tissue organization and functions in the body. - Explain the structure and role of nucleic acids in biological systems.		
Module 1	Tissue system-II	[15L]
Learning Objective		
Understand the classification and structure of muscular, connective, and nervous tissues.		
Learning Outcomes:		
- Analyze different types of tissues based on their structure, location, and function. - Differentiate muscular, connective, and nervous tissues with suitable examples. - Explain the functional significance of tissues in maintaining body organization. - Sketch and label the microscopic details of tissues		
1.1	Tissue System: 1.1.1 Muscular Tissue Types, structure, location and functions of: - Skeletal (striated) muscle - Smooth (non-striated) muscle - Cardiac muscle 1.1.2 Connective Tissue Classification, structure, location and functions of: - Loose connective tissue: - Areolar tissue - Adipose tissue - Dense connective tissue - Tendons - Ligaments - Supporting connective tissue - Cartilage - Bone - Fluid connective tissue	



	○ Blood ○ Lymph 1.1.3 Nervous Tissue Types, structure, location and functions of: • Neurons • Neuroglial cells	
Module 2	Molecular Biology	[15L]
Learning Objective • Understand the structure of nucleic acids (DNA and RNA). • Classify types of DNA and RNA.		
Learning Outcomes: • Analyze the structural components of nucleic acids including nucleotides and nitrogenous bases. • Explain the structure of DNA and RNA with key features such as base pairing and double helix. • Differentiate types of DNA and RNA based on structure and function. • Interpret the biological significance of nucleic acids in genetic information and cellular processes.		
2.1	2.1.1 Nucleic Acid Structure Components: • Structure of nucleotide (nitrogenous base, pentose sugar, phosphate) • Purines and pyrimidines • Nucleoside and nucleotide	
2.2	2.2.1 Structure of RNA • General structure of RNA • Differences from DNA 2.2.2 Structure of DNA • Watson and Crick model • Double helix structure • Antiparallel strands • Complementary base pairing • Hydrogen bonding	
2.3	2.3.1 Types of DNA • A-DNA • B-DNA • D-DNA • Z-DNA • C-DNA • E-DNA 2.3.2 Types of RNA	



	• mRNA (Messenger RNA) • tRNA (Transfer RNA) • rRNA (Ribosomal RNA) • hnRNA (Heterogeneous nuclear RNA / pre-mRNA) • snRNA (Small nuclear RNA) • snoRNA (Small nucleolar RNA) • miRNA (Micro RNA) • siRNA (Small interfering RNA) • piRNA (Piwi-interacting RNA)
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Mapping of COs and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Analyze different types of tissues based on their structure, location, and function.		X		X		
Differentiate muscular, connective, and nervous tissues with suitable examples.	X					
Explain the functional significance of tissues in maintaining body organization.			X			
Sketch and label the microscopic details of tissues	X	X				
Analyze different types of tissues based on their structure, location, and function.	X					



Differentiate muscular, connective, and nervous tissues with suitable examples.			X			
Explain the functional significance of tissues in maintaining body organization.			X			
Analyze the structural components of nucleic acids including nucleotides and nitrogenous bases.			X			
Explain the structure of DNA and RNA with key features such as base pairing and double helix.		X				
Differentiate types of DNA and RNA based on structure and function.				X		
Interpret the biological significance of nucleic acids in genetic information and cellular processes.			X			

Unit	Remembering (1)	Understanding (2)	Applying (3)	Analyzing (4)	Evaluating (5)	Creating (6)	Total
I	20%	50%	30%	-	-	-	100%
II	20%	50%	30%	-	-	-	100%

T.Y. B. Sc. (Zoology) SEMESTER V
Course Name: Tissue System II and Molecular Biology
Course Code: ZOOMN-S5PR5-2CR26
Theory [Credits - 02]

Course learning outcome

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

- Identify and differentiate various types of tissues (muscular, connective, and nervous) using microscopic slides.
- Describe the structural organization and functions of different tissues including skeletal, smooth, cardiac, connective, and nervous tissues.
- Perform basic hematological techniques such as blood smear preparation, blood grouping, hemoglobin estimation, and determination of bleeding and clotting time.
- Demonstrate understanding of tissue organization by correlating structure with function.
- Construct and interpret models of nucleic acid components including purines and pyrimidines.
- Illustrate the structure of DNA including double helix, antiparallel strands, and complementary base pairing.
- Explain the structure and differences of RNA compared to DNA.



- Develop laboratory skills, observation techniques, and scientific reporting abilities.

Practical Module (ZOOMN-S5PR4-2CR26)

[10L]

The following practical are to be taught / studied only with the help of charts, models, videos, photographs, permanent slides, working models etc.

1	Practical 1: Study of Muscular Tissues (Microscopic Slides) Aim: To study different types of muscular tissues under microscope. Tissues Studied: • Skeletal (striated) muscle • Smooth (non-striated) muscle • Cardiac muscle Practical 2: Study of Connective Tissues – Loose & Dense Aim: To study the structure of loose and dense connective tissues. Tissues Studied: • Areolar tissue • Adipose tissue • Tendon • Ligament Practical 3: Study of Supporting Connective Tissues Aim: To study supporting connective tissues. Tissues Studied: • Cartilage • Bone Practical 4: Study of Fluid Connective Tissues Aim: To study the preparation of • Blood smear • Blood Group • Blood clotting & Blood Bleeding time • Hemoglobin Estimation Practical 5: Study of Nervous Tissue Aim: To study nervous tissue under microscope. Structures Studied: • Neuron • Neuroglial cells (chart / slide) Practical 6: Model of Purines and Pyrimidines Aim: Use different colored beads to represent nitrogenous bases. • Arrange beads to show: ○ Purines (Adenine, Guanine – double ring structure) ○ Pyrimidines (Cytosine, Thymine, Uracil – single ring structure) Practical 7: Model of DNA Structure
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		Aim: Use beads to represent: Phosphate group, Deoxyribose sugar & Nitrogenous bases • Arrange in double helix form • Show: Antiparallel strands & Base pairing (A–T, G–C) Practical 8: Model of RNA Structure Aim: Use beads to construct a single-stranded structure • Show: Ribose sugar & Bases (A, U, G, C) • Highlight difference from DNA	

Mapping of COs and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Identify and differentiate various types of tissues (muscular, connective, and nervous) using microscopic slides.	X					
Describe the structural organization and functions of different tissues including skeletal, smooth, cardiac, connective, and nervous tissues.	X					
Perform basic hematological techniques such as blood smear preparation, blood grouping, hemoglobin estimation, and determination of bleeding and clotting time.		X				
Demonstrate understanding of tissue organization by correlating structure with function.	X					
Construct and interpret models of nucleic acid components including purines and pyrimidines.	X					
Illustrate the structure of DNA including double helix, antiparallel strands, and complementary base pairing.	X					
Explain the structure and differences of RNA compared to DNA.		X				
Develop laboratory skills, observation techniques, and scientific reporting abilities		X				
Identify and differentiate various types of tissues (muscular, connective, and nervous) using microscopic slides.	X		X			
Describe the structural organization and functions of different tissues including skeletal, smooth, cardiac, connective, and nervous tissues.	X		X			
Perform basic hematological techniques such as blood smear preparation, blood grouping, hemoglobin estimation, and determination of bleeding and clotting time.		X				



Demonstrate understanding of tissue organization by correlating structure with function.			X			
Construct and interpret models of nucleic acid components including purines and pyrimidines.			X			
Illustrate the structure of DNA including double helix, antiparallel strands, and complementary base pairing.		X	X			

T. Y. B. Sc.

SEMESTER V

Course Name: Non Chordates and Chordates

Course Code: ZOOMN-S5P5-2CR26

Theory [Credits -02]

Course learning outcome		
After successfully completing this course students will be able to: Classify different Non- Chordates phyla and Classification of Chordates up to orders		
Module1	<u>Non- Chordates</u>	[15L]
Learning Objective Students will learn Taxonomy of different phyla of invertebrates Identify animals as per phylum and class Classify animals up to orders		
Learning Outcomes: - Students can classify protozoa , porifera and cnidaria upto orders with reasons - Students will understand the evolutionary trends among lower animals. - Students will be Identify protozoans up to order level based on movement and lifestyle. - Students will identify poriferans based on spicule composition and body organization. - Students are able to classify cnidarians based on body form, symmetry, and polyp/medusa dominance.		
1.1	Classification of Non- Chordates phyla up to orders - Protozoa - Porifera - Cnidaria - Helminthes - Annelida - Arthropoda - Mollusca - Echinodermata	



Module2	Chordates	15L
Learning Objective Students will learn Taxonomy of different phyla of vertebrates Identify animals as per phylum and class Classify animals up to orders		
Learning Outcomes: • Students will understand and classify different class of vertebrate up to orders • Students will know different characters between different classes of chordates • Explain examples with its salient features • Students can distinguish vertebrate orders • Know different between chondrichthyes and oestichthyes • Understand salient features of Amphibia, Reptile, Aves and Mammal		
2.1	Classification of Chordates up to orders: • Protochordates • Cyclostomata • Pisces • Amphibia • Reptile • Aves • Mammal	



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**SIR P. T. SARVAJANIK COLLEGE OF SCIENCE, (AUTONOMOUS)
ATHWALINES, SURAT-395001**



Mapping of Cos and POs

Course Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Students can classify protozoa , porifera and cnidaria upto orders with reasons	X	X				
Students will understand the evolutionary trends among lower animals.		X				
Students can classify protozoa , porifera and cnidaria upto orders with reasons			X			
Students will understand different system of scorpion like		X				
Students will understand and classify different class of vertebrate up to orders		X				
Students will know different characters between different classes of chordates	X					
Explain examples with its salient features	X					
Students can distinguish vertebrate orders		X				

Unit	Remembering (1)	Understanding (2)	Applying (3)	Analyzing (4)	Evaluating (5)	Creating (6)	Total
I	30	60	10	-	-	-	100%
II	30	70	-	-	-	-	100%



T. Y. B. Sc.
SEMESTER V
Course Name: Non Chordates and Chordates
Course Code: ZOOMN-S5PR5-2CR26
Practical [Credits -02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

- Classify different Non– Chordates phyla and Classification of Chordates up to orders
- Identify different organisms as per characters
- Distinguish vertebrate orders

The following practical are to be studied with the help of charts, models ,videos, photographs, permanent slides, working models, etc.

1	Classification of following animals up to orders: Protozoa: Trypanosoma, Monocystis, Vorticella
2	Classification of following animals up to orders: Porifera: Grantia, Euplectella, Spongilla
3	Classification of following animals up to orders: Cnidaria: Hydra, Cyanea, Gorgonia
3	Classification of following animals up to orders: Helminthes: Fasciola hepatica, Taeniasaginata, Wuchereria bancrofti
4	Classification of following animals up to orders: Annelida: Sabella, Lumbricus, Acanthobdella
5	Classification of following animals up to orders: Arthropoda: Lobster, Spider, Leaf Insect, Nepa
6	Classification of following animals up to orders: Mollusca: Cyprea, Limnea, Mytilus, Sepia, Nautilus,
7	Classification of following animals up to orders: Echinodermata: Astropecten, Ophioderma, Strongylocentrotus, Synapta
8	Classification of following animals up to orders: Protochordates: Ascidia, Amphioxus, Salpa, Doliolum
9	Classification of following animals up to orders: Cyclostomata: Lamorey, Myxine



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10	Classification of following animals up to orders: Pisces: Electric ray, Sting ray, Scoliodon, Hammer headed shark, Pristis, Labeo, Mrigal, Ophiocephalus, Flat fish, Scorpion fish, Bombay duck, Pipe fish.
11	Classification of following animals up to orders: Amphibia: Ichthyophis, Salamander, Frog, Pipa, Tree frog.
12	Classification of following animals up to orders: Reptile: Turtle, Calotes, Cobra, Dhaman, Python, Krait
13	Classification of following animals up to orders: Aves: Archaeopteryx, Pigeon, Owl, Sparrow, Kite, Pelican
14	Classification of following animals up to orders: Mammal: Duck billed platypus, Kangaroo, Monkey, Mongoose, Squirrel, Rabbit, Deer

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Classify different Non- Chordates phyla up to orders		X				
Classify different Chordates phyla up to orders		X				
Identify different organisms as per characters	X					
Distinguish vertebrate orders		X				