



Re-Accredited 'B++' 2.86 CGPA by NAAC

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**

University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.

**વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી**

યુનિવર્સિટી કેમ્પસ, ઉદ્ધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.


Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888  
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

## **-: પરિપત્ર :-**

યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫-૨૬ થી અમલમાં આવનાર T.Y. B.Sc. Zoology Sem.-5 & 6 Major, Minor અને SEC નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ સંદર્ભે પ્રાણીશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૨૯/૦૩/૨૦૨૫ ની સભાના ઠરાવ ક્રમાંક:૦૨ થી કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંક:૯ થી કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૫/૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંક: ૭૬ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણ: ઉપર મુજબ

ક્રમાંક:ઓથો./પરિપત્ર/સિલેબસ/૧૧૯૫૧/૨૦૨૫  
તા.૨૬-૦૫-૨૦૨૫

  
કુલસચિવ

પ્રતિ,

- ૧) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.  
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
- ૨) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.
- ૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.  
.....તરફ જાણ તેમજ અમલ સારૂ.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY,  
SURAT.**



**Undergraduate Programme  
In  
Zoology**

**[3 Years (Degree) & 4 Years (Honours/Honours with Research)]**

Undergraduate Programme in Zoology as per NEP 2020[3 Years (Degree) & 4 Years (Honours/Honours with Research)]

*Handwritten signature*

## **Programme Outcome (PO):**

**PO-01: Scientific Knowledge & Conceptual Understanding:** Develop a strong foundation in scientific principles, theories and concepts across disciplines, fostering interdisciplinary learning, advance knowledge and problem-solving abilities.

**PO-02: Analytical & Critical Thinking:** Apply critical thinking and analytical reasoning to evaluate scientific data, hypotheses and real-world problems, leading to evidence-based conclusions.

**PO-03: Research & Inquiry-based Learning:** Develop investigative skills through experimentation, data analysis and scientific inquiry to contribute to research and innovation.

**PO-04: Laboratory & Technical Skills:** Gain hands-on experience with laboratory techniques, instrumentation and computational tools relevant to scientific research and industry applications.

**PO-05: Digital & Computational Literacy:** Utilize digital tools, computational techniques and emerging technologies such as AI, bioinformatics and statistical modelling to enhance scientific learning and problem-solving.

**PO-06: Environmental & Societal Responsibility:** Understand the role of science in addressing environmental, health and societal challenges, promoting sustainability and ethical responsibility.

**PO-07: Effective Communication & Collaboration:** Develop proficiency in scientific communication, both written and oral, for effective dissemination of knowledge while collaborating in multidisciplinary teams.

**PO-08: Innovation & Entrepreneurship:** Foster an entrepreneurial mind-set by applying scientific knowledge for innovation, technology development, and industry-oriented applications. Develop sustainable solutions to address real-world challenges in research and environmental management.

**PO-09: Lifelong Learning & Professional Growth:** Cultivate curiosity and adaptability for continuous learning, equipping students for higher education, research, and professional careers.

**PO-10: Ethical Leadership & Value-based Education:** Develop leadership qualities, ethical values, and a sense of responsibility in applying science for societal progress, aligning with Indian knowledge systems and global perspectives.

*Arsh*

## **Programme Specific Outcome (PSO):**

### **1. Remembering (Knowledge)**

PSO1: Recall the classification, morphology, and anatomy of different animal groups and Identify key concepts and terminology in zoology.

### **2. Understanding (Comprehension)**

PSO2: Explain the structure and function of animal systems, such as nervous, circulatory, and digestive systems and Interpret zoological data and graphs related to animal populations and ecosystems.

### **3. Applying (Application)**

PSO3: Apply zoological principles to understand animal behaviour, ecology, and evolution and Use zoological concepts to analyze real-world scenarios related to conservation, wildlife management, and animal welfare.

### **4. Analyzing (Analysis)**

PSO4: Break down complex zoological concepts, such as animal development and physiology, into component parts and Evaluate zoological evidence to support a claim related to animal diversity, adaptation, and extinction.

### **5. Evaluating (Synthesis)**

PSO5: Design experiments to investigate zoological questions and hypotheses related to animal behavior, ecology, and evolution and Critique zoological research and methodologies related to animal conservation and management.

### **6. Creating (Evaluation)**

PSO6: Develop innovative solutions to zoological problems related to animal conservation, welfare, and management and Communicate zoological findings effectively through various media, such as research papers, presentations, and popular articles.

*Asheh*

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
Undergraduate Programme in Zoology - Major  
 Teaching & Evaluation Scheme Semester-V & VI

[Academic Year of Implementation 2025-2026]

**Semester-V**

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
ZO – MJ – 501	Biochemistry	2	1:00	25	25	50	2
ZOP – MJ – 501	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>
ZO – MJ – 502	Non-chordates and Chordates-III	2	1:00	25	25	50	2
ZOP – MJ – 502	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>
ZO – MJ – 503	Bhartiya Gyan Parrampara in Zoology – I – BGP	2	1:00	25	25	50	2
ZOP – MJ – 503	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>

**Semester-VI**

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
ZO – MJ – 601	Animal physiology and endocrinology	2	1:00	25	25	50	2
ZOP – MJ – 601	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>
ZO – MJ – 602	Non-chordates and Chordates-IV	2	1:00	25	25	50	2
ZOP – MJ – 602	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>
ZO – MJ – 603	Bhartiya Gyan Parrampara in Zoology – II – BGP	2	1:00	25	25	50	2
ZOP – MJ – 603	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>

Undergraduate Programme in Zoology as per NEP 2020[3 Years (Degree) & 4 Years (Honours/Honours with Research)]

*Ashub*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
Undergraduate Programme in Zoology – Minor Elective  
**Teaching & Evaluation Scheme Semester-V & VI**

[Academic Year of Implementation 2025-2026]

**Semester-V**

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
ZO – ME – 501	Biochemistry	2	1:00	25	25	50	2
ZOP – ME – 501	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>
ZO – ME – 502	Non-chordates and Chordates – III	2	1:00	25	25	50	2
ZOP – ME – 502	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>

**Semester-VI**

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
ZO – ME – 601	Animal physiology	2	1:00	25	25	50	2
ZOP – ME – 601	Practical	4	4:00	25	25	50	2
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>4</b>

Undergraduate Programme in Zoology as per NEP 2020[3 Years (Degree) & 4 Years (Honours/Honours with Research)]

*Handwritten signature*

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT  
Undergraduate Programme in Zoology  
Skill Enhancement Course  
 Teaching & Evaluation Scheme Semester-V & VI  
 [Academic Year of Implementation 2025-2026]

**Semester-V**

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
ZO-SEC-501	Bioinstrumentation	1	0:30	12	13	25	1
ZOP-SEC-501	Practical	2	2:00	12	13	25	1
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>2</b>

*Handwritten signature*

[Subject code-2503000505015001]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester - V: Course: ZO-MJ-501: Biochemistry**

Course code	ZO – MJ – 501						
Course title	Biochemistry						
Course level	300 – 399						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The Biochemistry course in Zoology aims to provide students with an understanding of the molecular and biochemical processes in animals, focusing on metabolic pathways, enzymes, and the role of biomolecules in physiological functions.						
Course objective	<ul style="list-style-type: none"> <li>• To explore the structure and function of biomolecules like proteins, lipids, and nucleic acids in animals.</li> <li>• To understand metabolic pathways and the regulation of biochemical processes in animal systems.</li> <li>• To examine the role of enzymes in metabolism and their importance in maintaining homeostasis.</li> </ul>						
Course outcomes	CO1: Understand enzyme classification, specificity, kinetics and Analyze enzyme regulation and inhibition. CO2: Understand the structure and properties of nucleic acids. CO3: Analyze DNA denaturation, renaturation, and the concept of hypo- and hyperchromicity. Understand and Explain Key Metabolic Pathways. CO4: Comprehend Lipid Metabolism and Examine Amino Acid Catabolism and Nitrogen Disposal						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓	✓				✓
	CO2	✓	✓				
	CO3	✓	✓	✓	✓	✓	
	CO4	✓	✓		✓	✓	✓
Pre-requisite	Biology, Basic Zoology, Basic Biochemistry						
Course content	<b>UNIT 1 : Chemistry of Biomolecules</b> <b>1.1 Metabolism of Carbohydrates, Lipids and Proteins</b> <b>Carbohydrates:</b>						

*Ashish*

	<ul style="list-style-type: none"> <li>• Glycolysis</li> <li>• Citric acid cycle</li> <li>• Gluconeogenesis</li> <li>• Glycogenolysis</li> <li>• Glycogenesis</li> <li>• Phosphate pentose pathway</li> </ul> <p><b>Lipids:</b></p> <ul style="list-style-type: none"> <li>• Biosynthesis of palmitic acid</li> <li>• <math>\beta</math>-oxidation of saturated fatty acids</li> <li>• Ketogenesis</li> </ul> <p><b>Catabolism of amino acids:</b></p> <ul style="list-style-type: none"> <li>• Transamination</li> <li>• Deamination</li> <li>• Biosynthesis of amino acids</li> <li>• Ornithine Cycle (Urea cycle)</li> </ul> <p><b>1.2 Nucleic Acid Structure:</b></p> <ul style="list-style-type: none"> <li>• Purines</li> <li>• Pyrimidines</li> <li>• Nucleosides</li> <li>• Nucleotide</li> </ul> <p><b>Nucleic acids Cot Curves:</b></p> <ul style="list-style-type: none"> <li>• Base pairing Denaturation and Renaturation of DNA</li> <li>• Types of DNA and RNA</li> <li>• Complementarity of DNA</li> <li>• Hpyo and Hyperchromaticity of DNA</li> </ul> <p><b>UNIT 2 : Enzyme Biochemistry</b></p> <ul style="list-style-type: none"> <li>• Nomenclature and classification</li> <li>• Cofactors</li> <li>• Specificity of enzyme action</li> <li>• Isozymes</li> <li>• Mechanism of enzyme action</li> <li>• Enzyme kinetics: Factors affecting rate of enzyme-catalyzed reactions</li> <li>• Derivation of Michaelis-Menten equation</li> <li>• Concept of <math>K_m</math> and <math>V_{max}</math></li> <li>• Lineweaver-Burk plot</li> <li>• Enzyme inhibition</li> <li>• Allosteric enzymes and their kinetics &amp; Regulation of enzyme action</li> <li>• Enzymes in diagnostics</li> <li>• Medicines and research</li> <li>• Enzyme therapy</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• Nelson &amp; Cox: Lehninger's Principles of Biochemistry: McMillan (2000)</li> <li>• Zubayet al: Principles of Biochemistry: WCB (1995)</li> </ul>

*Aashish*

	<ul style="list-style-type: none"> <li>• Voet&amp;Voet: Biochemistry Vols 1 &amp; 2: Wiley (2004) 4.</li> <li>• Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003)</li> <li>• Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press</li> <li>• Satyanarayan and Chakrapani , (2017) Biochemistry, Elsevier; Fifth edition.</li> <li>• Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.</li> <li>• Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.</li> <li>• Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.</li> </ul>
e-learning resources	<a href="https://www.youtube.com/watch?v=ti9SbKgMEic">https://www.youtube.com/watch?v=ti9SbKgMEic</a> <a href="https://www.youtube.com/watch?v=ng8823q42JE">https://www.youtube.com/watch?v=ng8823q42JE</a> <a href="https://www.youtube.com/watch?v=spwDq9ZG Tg">https://www.youtube.com/watch?v=spwDq9ZG Tg</a> <a href="https://www.youtube.com/watch?v=EzuKxqojS0Q">https://www.youtube.com/watch?v=EzuKxqojS0Q</a> <a href="https://www.youtube.com/watch?v=NvTcWpPrLNA">https://www.youtube.com/watch?v=NvTcWpPrLNA</a> <a href="https://www.youtube.com/watch?v=v-QAXrIDXFE">https://www.youtube.com/watch?v=v-QAXrIDXFE</a> <a href="https://www.youtube.com/watch?v=V4906m8VkJTE">https://www.youtube.com/watch?v=V4906m8VkJTE</a> <a href="https://www.youtube.com/watch?v=wLx8D3H1UOQ">https://www.youtube.com/watch?v=wLx8D3H1UOQ</a> <a href="https://www.youtube.com/watch?v=MefANbnSdH0">https://www.youtube.com/watch?v=MefANbnSdH0</a>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or / and Assignment

*Heshu*

[Subject Code-2503000505015002]

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

### Semester - V: Course: ZOP-MJ-501: Practical in Biochemistry

Course code	ZOP – MJ – 501
Course title	Practical in Biochemistry
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The Biochemistry Practical course in Zoology aims to provide students with hands-on experience in analyzing the biochemical composition and metabolic processes in animals, focusing on techniques used in biochemistry.
Course objective	<ul style="list-style-type: none"><li>• To develop practical skills in performing biochemical tests and analyzing macromolecules like proteins, lipids, and carbohydrates.</li><li>• To understand the enzymatic activities and metabolic pathways in animals through experiments.</li><li>• To apply laboratory techniques to explore the biochemical basis of animal physiology and health.</li></ul>
Course content	<ol style="list-style-type: none"><li>1. Effect of pH on salivary amylase activity.</li><li>2. Effect of Temperature on salivary amylase activity.</li><li>3. Estimation of total protein by Lowry's method.</li><li>4. Determination of <math>K_m</math> and <math>V_{max}</math> using Lineweaver-Burk graph. (Dry experiment)</li><li>5. To identify and distinguish between Purine and Pyrimidine bases.</li><li>6. To study structure of DNA and RNA with the help of charts.</li><li>7. To study different types of DNA with the help of charts / models.</li><li>8. To study different types of DNA with the help of charts / models.</li><li>9. To study Carbohydrate metabolism with help of charts – Glycolysis, Krebs Cycle, Gluconeogenesis.</li><li>10. To study Urea cycle with help of charts.</li><li>11. To study <math>\beta</math> – Oxidation of Fatty acid with help of charts.</li></ol>
Reference books	Principles and techniques of biochemistry and molecular biology Edition: 7 <sup>th</sup> by Wilson & Walker Varley's practical clinical biochemistry Edition: 6 <sup>th</sup> by Gowenlock, Alan
Teaching methodology	Laboratory work. Journal Preparation

*Ashish*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester - V: Course: ZO-MJ-502: Non-Chordates And Chordates - III**

Course code	ZO – MJ – 502						
Course title	Non-Chordates And Chordates – III						
Course level	300 – 399						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The course on Chordate and Non-Chordate Zoology aims to provide students with a comprehensive understanding of the classification, structure, and evolutionary relationships of various invertebrate and vertebrate animals.						
Course objective	<ul style="list-style-type: none"> <li>• To explore the diverse anatomical and physiological features of chordates and non-chordates.</li> <li>• To understand the evolutionary significance and adaptations of these organisms.</li> <li>• To develop skills in identifying, classifying, and analyzing different species within these two major animal groups.</li> </ul>						
Course outcomes	<p>CO1: Learn about the importance of systematic, taxonomy and structural organization of animals and Getting familiarized with the morphology and anatomy of representatives of various animals' groups.</p> <p>CO2: Explain comparative account of different vertebrate skeletal systems; understand the pattern of evolution, structural organization and functions.</p> <p>CO3: Students recognize structural principles by studying all body systems of animal type and Know the behaviour pattern like parenting.</p> <p>CO4: Enhance collaborative learning and communication skills through practical sessions, team work and assignments and Practical curriculum includes museum specimens of various phyla and classes</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓	✓		✓		✓
	CO2	✓	✓	✓		✓	✓
	CO3		✓	✓	✓	✓	✓
	CO4	✓	✓	✓	✓	✓	✓

*(Handwritten signature)*

Pre-requisite	Biology, Basic Zoology and Classification
Course content	<p><b>UNIT 1 : Nonchordates</b></p> <p><b>1.1 Taxonomy of Nonchordates to be studied up to order</b></p> <ul style="list-style-type: none"> <li>• Protozoa</li> <li>• Porifera</li> <li>• Cnidaria</li> <li>• Helminthes</li> <li>• Annelida</li> </ul> <p><b>1.2 Study of the following animal types with reference to the Structure and functions of various organs of all systems: Leech</b></p> <ul style="list-style-type: none"> <li>• External features</li> <li>• Digestive system</li> <li>• Haemocoelomic system</li> <li>• Excretory system</li> <li>• Nervous system</li> <li>• Reproductive system</li> <li>• Parasitic adaptation</li> </ul> <p><b>UNIT 2 : Chordates</b></p> <p><b>2.1 Taxonomy of chordate to be studied up to order</b></p> <ul style="list-style-type: none"> <li>• Protochordata</li> <li>• Cyclostomata</li> <li>• Pisces</li> <li>• Amphibia</li> </ul> <p><b>2.2 Amplifications of chordates and Osteology</b></p> <p>Types of scales in Pisces Parental care in Pisces Neoteny in Amphibia Comparative study of vertebrates</p> <ul style="list-style-type: none"> <li>• Pectoral girdles</li> <li>• Pelvic girdle</li> <li>• Fore limbs</li> <li>• Hind limbs</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• A Text Book of General Biology - Tomer &amp; Singh. Rastogi Publication, Meerut</li> <li>• Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.</li> <li>• Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.</li> <li>• Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students, Asia Publishing Home.</li> <li>• Chordate Zoology E.L Jordan &amp; P. S. Verma. S.Chand</li> </ul>

*Handwritten signature*

	<ul style="list-style-type: none"> <li>• Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.</li> <li>• Holland, P. (2011) The Animal Kingdom: A Very Short Introduction Oxford University Press.</li> <li>• Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw-Hill.</li> <li>• Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.</li> <li>• Modern Text Book of Zoology Prof. R. L. Kotpal Invertebrates Rastogi publication, 11<sup>th</sup> edition 2019-2020A</li> <li>• Outline of comparative anatomy of vertebrate Kingsley J.S. Central book depot, Allahabad</li> <li>• Parker and Haswell. Text Book of ZOOLOGY (Invertebrate)</li> <li>• PrushthvanshiPraniyoaneGarbhvidya - A.B.Vyas. Guj. GranthNirman Board.</li> <li>• Text Book of Invertebrates. Saras publication</li> <li>• Text Book of Chordates - A. Thangamani, S. Prasanna Kumar</li> <li>• Text book of Zoology - R. D. Vidyarthi. S.Chand</li> <li>• Text Book of Zoology - S.N. Prasad. Vikas Publishing House pvt.ltd. Delhi</li> <li>• The vertebrate Body by Romer Alfred Sherwood, Publisher: W, b, Saunders Company London.</li> <li>• UtkrushthaAprushthvanshiPraniyo - U.M.Rawal. Guj.Granthnirman Board.</li> <li>• Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.</li> </ul>
e-learning resources	<a href="http://egymkosh.ac.in/bitstream/123456789/16496/1/Unit-9.pdf">http://egymkosh.ac.in/bitstream/123456789/16496/1/Unit-9.pdf</a> <a href="https://biologywise.com/information-about-hydrostatic-skeleton">https://biologywise.com/information-about-hydrostatic-skeleton</a>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment

*Handwritten signature*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester - V: Course: ZOP-MJ-502:****Practical in Non-Chordates and Chordates - III**

Course code	ZOP – MJ – 502
Course title	Practical in Non-Chordates and Chordates – III
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The course on Chordate and Non-Chordate Practical Zoology aims to provide hands-on experience in the identification and study of various chordate and non-chordate species to enhance practical understanding of their anatomy and physiology.
Course objective	<ul style="list-style-type: none"> <li>• To learn the identification techniques and classification of various species.</li> <li>• To gain insights into the functional anatomy and adaptive features of these organisms through laboratory exercises.</li> </ul>
Course content	<p>1. Classification of following animals up to order:</p> <p>I. Protozoa: Ceratium, Entamoeba, Polystomella, Plasmodium, Opalina Balantidium</p> <p>II. Porifera: Leucosolenia, Pheronema, Euspongia</p> <p>III. Cnidaria: Obelia, Millipora, Vaella, Rhizostoma, Tubipora Alcyonium, Cerianthus, Pennatula, Adamsia, Zoanthus Favia, Fungia, Astrea</p> <p>IV. Platyhelminthes: Bipalium, Opisthorchis</p> <p>V. Nementelminthes: Trichinella, Wacheria</p> <p>VI. Annelida: Sabella, Serpula, Arenicola, Acanthobdella,</p> <p>2. The following practical of <b>Leech</b> to be taught/studied only with the help of Charts/models/videos/photographs/permanent slides, working models, simulators etc.</p>

	<p>I. External features and Digestive system  II. Nervous system,  III. Reproductive system  IV. Mountings: Jaws, Salivary glands, Ovary and Testicular Nephridia</p> <p>3. Classification of following animals up to order:  I. Protochordates: Ciona, Doliolum and Salpa  II. Cyclostomata: Bdelostoma  III. Pisces: Sphyrna, (Skates), Harpodon, Clarius, Eel, Tetradon, Flute fish, Acipenser, Pterois and Lepidosiren/Neoceratodus  IV. Amphibia: Ichthyophis, Necturus, Amphiuma, Alytes and Pipa</p> <p>4. Parental care in fishes :Gasterosteus, Rhodeus, Kurtus, Hippocampus/ Pipe fish, Tilapia and Skate (Mermaids purse)</p> <p>5. Types of scales in fishes: Placoid, Cycloid and Ctenoid</p> <p>6. Neoteny in Amphibia: Axolotal larva, Typhlomolge, Necturus</p> <p>7. Comparative study of osteology in vertebrates:</p> <ul style="list-style-type: none"> <li>• Pectoral girdles</li> <li>• Pelvic girdle</li> <li>• Fore limbs</li> <li>• Hind limbs</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• Vertebrate Zoology: An Experimental Field Approach-Nelson G. Hairston. Cambridge University Press, 1994</li> <li>• A Manual of Zoology Vol. I &amp; II - Ekambernath Ayar. S. Vishwanathan Chennai.</li> <li>• Practical Zoology by S. Lal</li> </ul>
Teaching methodology	Laboratory work. Journal Preparation

*Handwritten signature*

[Subject Code-2503000505035001]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester - V: Course: ZO-MJ-503:**

**Bhartiya Gyan Parampara in Zoology – I – BGP**

Course code	ZO – MJ – 503						
Course title	Bhartiya Gyan Parrampara in Zoology – I – BGP						
Course level	300 – 399						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	This course aims to explore the historical, cultural, and scientific aspects of Indian Knowledge Systems (IKS) in zoology, focusing on ancient animal classification, ethical frameworks, and the significance of cows in agriculture and ecology.						
Course objective	<ul style="list-style-type: none"> <li>• To understand the historical development of animal sciences in ancient India and its texts.</li> <li>• To explore traditional classifications and the significance of cows in agriculture and medicine.</li> <li>• To examine modern interpretations of IKS and their relevance to sustainable practices in zoology and farming.</li> </ul>						
Course outcomes	<p>CO1: Explain the fundamental principles and importance of Indian Knowledge Systems in the context of Zoology and Compare and contrast the ancient Indian classification of animals with modern taxonomic systems.</p> <p>CO2: Analyze the scientific basis behind the classification of animals into various Vargas according to Vedic literature and Evaluate the cultural, spiritual, and ecological significance of cows in Indian tradition and compare their status across different religions.</p> <p>CO3: Interpret the symbolism of animals (particularly snakes) in Indian mythology, spiritual practices, and traditional medicine.</p> <p>CO4: Apply traditional knowledge about animals to address contemporary challenges in conservation, sustainable development, and ecological balance.</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	<b>CO1</b>	✓	✓	✓	✓		✓
	<b>CO2</b>	✓	✓	✓	✓		✓

*Handwritten signature*

	<b>CO3</b>	✓	✓	✓	✓	✓	✓
	<b>CO4</b>	✓	✓	✓	✓	✓	✓
Pre-requisite	Biology, Basic Zoology						
Course content	<p><b>UNIT 1 Generic Indian Knowledge Systems (IKS) in Zoology</b>  <b>Importance of Indian Knowledge System for Zoology</b>  Historical development of animal sciences in ancient India  Key texts and sources: Vedas, Upanishads, CharakaSamhita, SushrutaSamhita  Concept of interconnectedness in Indian tradition  Ethical framework for human-animal relationships  <b>Ancient Indian Classification of Animals</b>  Chaturvimshati classification (24 types)  Classification based on origin: Jarayuja, Andaja, Swedaja, Udbhijja  Classification based on habitat and characteristics  Comparison with Linnaean taxonomy  <b>Different Varga as per Vedas</b>  JalaVarga: Aquatic animals and their significance  DugdhaVarga: Milk-producing animals and milk products  MadhuVarga: Honey bees and other insects producing beneficial substances  MamsaVarga: Classification of animals based on their flesh characteristics  MutraVarga: Understanding of medicinal properties of animal urine  <b>UNIT 2 Subject Specific IKS - Cow Science (Gomata Vigyan)</b>  <b>Significance of Cow (Gomata)</b>  Care and protection of indigenous cattle breeds  Scientific understanding of Panchagavya (five cow products)  Ecological and agricultural importance  Nutritional and medicinal properties of cow products  <b>Voice of Cows: Contemporary Interpretations</b>  Bhaktivedanta Swami Goshala model  Modern research on cow behavior and communication  Case studies of successful indigenous cattle conservation programs  <b>Cows in Vedic Literature</b>  References in Rig Veda, Atharva Veda, Yajur Veda  Narratives in HarivamshaPurana and SrimadBhagavatam  Teachings of Gavopanishad  Interpretation of RikSamhita verses related to cows  <b>Breeds of Cow:</b>  Milch breeds: Gir, Shival, Red sindhi, Deoni  Draught resistant breeds: Kankrerj, Kangayam, Malvi, Siri  Dual breeds: Haryana, Ongole, Tharparkar, Rathi</p>						

*[Handwritten signature]*

	<p><b>Importance of Cows in Agriculture</b></p> <p>Traditional organic farming using cow-based inputs</p> <p>Soil health and cow-based fertilizers</p> <p>Pest management using cow products</p> <p>Integration of cattle in sustainable agricultural system</p>
Reference books	<ul style="list-style-type: none"> <li>• Dravyaguna Vijnan, Vol.III, Dr. J.L.N.Sastry, Chaukhambha Orientalai, Varanasi.</li> <li>• Gau-ank, Geeta press, Gorakhpur</li> <li>• Voice of Cows: The Newsletter of Bhaktivedanta Swami Goshala Vrindavan, February 2014-Vol14-Issue2</li> </ul>
e-learning resources	<p><a href="https://www.dattapeetham.org/page/view/significance-of-a-cow">https://www.dattapeetham.org/page/view/significance-of-a-cow</a></p> <p><a href="https://www.abtakmedia.com/without-vedas-therehttps://www.karigarofficial.com">https://www.abtakmedia.com/without-vedas-therehttps://www.karigarofficial.com</a></p> <p><a href="https://svastika.in">https://svastika.in</a></p> <p><a href="https://www.asianagrihistory.org/pdf/volume10/veterniray.pdf">https://www.asianagrihistory.org/pdf/volume10/veterniray.pdf</a></p> <p><a href="https://en.wikipedia.org/wiki/Indian_natural_history">https://en.wikipedia.org/wiki/Indian_natural_history</a></p> <p><a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC2997667/">https://pmc.ncbi.nlm.nih.gov/articles/PMC2997667/</a></p> <p><a href="https://www.britannica.com/place/India/Agriculture-and-animal-husbandry">https://www.britannica.com/place/India/Agriculture-and-animal-husbandry</a></p> <p><a href="https://en.wikipedia.org/wiki/History_of_zoology_through_1859">https://en.wikipedia.org/wiki/History_of_zoology_through_1859</a></p> <p><a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC3094705/">https://pmc.ncbi.nlm.nih.gov/articles/PMC3094705/</a></p> <p><a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC8514395/">https://pmc.ncbi.nlm.nih.gov/articles/PMC8514395/</a></p> <p><a href="https://www.britannica.com/topic/agriculture/The-Indian-subcontinent">https://www.britannica.com/topic/agriculture/The-Indian-subcontinent</a></p> <p><a href="https://www.indiatoday.in/amp/india/story/maharashtra-bjp-nda-indigenous-cow-rajyamata-gomata-assembly-election-2608721-2024-09-20">https://www.indiatoday.in/amp/india/story/maharashtra-bjp-nda-indigenous-cow-rajyamata-gomata-assembly-election-2608721-2024-09-20</a></p> <p><a href="https://www.ndtv.com/india-news/maharashtra-citing-vedic-significance-declares-cow-as-rajyamata-gomata-6683398">https://www.ndtv.com/india-news/maharashtra-citing-vedic-significance-declares-cow-as-rajyamata-gomata-6683398</a></p> <p><a href="https://www.businesstoday.in/india/story/ahead-of-polls-maharashtra-declares-indigenous-cows-as-rajyamata-gomata-448161-2024-09-30">https://www.businesstoday.in/india/story/ahead-of-polls-maharashtra-declares-indigenous-cows-as-rajyamata-gomata-448161-2024-09-30</a></p> <p><a href="https://www.anaadi.org/post/hindu-perspective-of-gomata">https://www.anaadi.org/post/hindu-perspective-of-gomata</a></p> <p><a href="https://www.tribuneindia.com/news/india/maharashtra-government-declares-desi-cows-rajyamata-gomata/">https://www.tribuneindia.com/news/india/maharashtra-government-declares-desi-cows-rajyamata-gomata/</a></p> <p><a href="https://economictimes.indiatimes.com/news/india/maharashtra-declares-indigenous-cows-rajyamata-gomata-ahead-of-assembly-elections/videoshow/113824550.cms">https://economictimes.indiatimes.com/news/india/maharashtra-declares-indigenous-cows-rajyamata-gomata-ahead-of-assembly-elections/videoshow/113824550.cms</a></p> <p><a href="https://www.ask-oracle.com/article/the-sacred-cow-unveiling-the-reverence-for-gomata-in-hinduism/">https://www.ask-oracle.com/article/the-sacred-cow-unveiling-the-reverence-for-gomata-in-hinduism/</a></p>
Teaching methodology	Class work, Discussion, Projects, Seminars or/and Assignment

*Handwritten signature*

[Subject Code-2503000505035002]

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

### Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

#### Semester - V: Course: ZOP-MJ-503:

#### Practical in Bhartiya Gyan Parampara in Zoology – I - BGP

Course code	ZOP – MJ – 503
Course title	Practical in Bhartiya Gyan Parampara in Zoology – I – BGP
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The practical course aims to provide hands-on experience in studying Indian Knowledge Systems in zoology, focusing on animal classification, cow science, and traditional practices in agriculture and medicine.
Course objective	<ul style="list-style-type: none"><li>• To develop practical skills in identifying animal classifications and understanding their cultural significance.</li><li>• To explore the ecological and agricultural applications of cow-based practices and products.</li><li>• To conduct experiments and case studies related to sustainable animal care and farming practices in the context of IKS.</li></ul>
Course content	<ol style="list-style-type: none"><li>1. To study ancient classification of animals.</li><li>2. To study different types of honey on the bases of the colour.</li><li>3. To study importance of panchagavya.</li><li>4. To study significance of kamdhenu cow.</li><li>5. To study milch breeds of cow: Gir, Shival, Red sindhi, Deoni</li><li>6. To study Draught resistant breeds: Kankrerj, Kangayam, Malvi, Siri</li><li>7. To study Dual breeds: Haryana, Ongole, Tharparkar, Rathi.</li></ol>
Reference books	As per theory
Teaching methodology	Laboratory work. Journal Preparation

*[Handwritten signature]*

[Subject Code-2503000505065001]

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

### Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

#### Semester - V: Course: ZO-SEC-501: Bioinstrumentation

Course code	ZO-SEC-501						
Course title	Bioinstrumentation						
Course level	300 – 399						
Credit	01						
Total engagement	1 credits x 15 hrs. = 15 hrs.						
Teaching per week	01 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The Bioinstrumentation course in Zoology aims to introduce students to the principles and applications of modern instruments used in biological research to analyze and measure biological systems.						
Course objective	<ul style="list-style-type: none"> <li>To understand the theoretical principles behind bioinstrumentation techniques used in zoological studies.</li> <li>To explore the various types of bioanalytical instruments and their applications in animal physiology, biochemistry, and ecology.</li> <li>To develop practical skills in operating bioinstrumentation tools for data collection and analysis in biological research.</li> </ul>						
Course outcomes	<p>CO1: Students will be able to understand and explain principal of different microscopes</p> <p>CO2: Students will be able to describe s different parts of microscopes</p> <p>CO3: Students will be able to explain application of different microscopes</p> <p>CO4: Students will be able to understand and learn preparation of slides</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓			✓		✓
	CO2	✓	✓	✓	✓	✓	✓
	CO3	✓			✓	✓	✓
	CO4	✓			✓	✓	✓
Pre-requisite	Biology, Basic Zoology						
Course content	<p><b>UNIT 1 Bio instruments: Principle, Structure and its application</b></p> <ul style="list-style-type: none"> <li>Light microscope</li> <li>Binocular microscope (Mono-objective &amp; Stereoscopic)</li> <li>Phase contrast microscope</li> <li>Fluorescent microscope</li> </ul>						

*Apes hub*

	<ul style="list-style-type: none"> <li>• Inverted microscope</li> <li>• Microtomy</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• Microscopy and Micro technique by R. Marimuthu. MJP Publishers Chennai.</li> <li>• Springer handbook of microscopy by Peter Haukes, John Spance - 2019</li> <li>• Microscopy: A very short introduction by Terence David Allm - 2015</li> <li>• Fundamentals of Light microscopy and electronic imaging by Douglas Murphy, Michael Davidson – 2013</li> <li>• E-learning resources – Microscopy - Micro Notes</li> <li>• Practical zoology Invertebrates by S. S. Lal, Rastogi Publication, Meerut – New Delhi.</li> </ul>
e-learning resources	Swayam Portal
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment

*Sreshth*

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

## Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

### Semester - V: Course: ZOP-SEC-501: Practical in Bioinstrumentation

Course code	ZOP – SEC – 501
Course title	Practical in Bioinstrumentation
Course level	300 – 399
Credit	01
Total engagement	1 credits x 30 hrs. = 30 hrs.
Teaching per week	02 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The Bioinstrumentation Practical course in Zoology aims to provide students with hands-on experience in using laboratory instruments to study biological systems and analyze data in zoological research.
Course objective	<ul style="list-style-type: none"><li>• To familiarize students with the operation and applications of bioinstrumentation tools in biological research.</li><li>• To analyze and interpret data obtained from bioinstrumentation methods for studying animal physiology and biochemistry.</li></ul>
Course content	To study following bio-instruments principle, structure and application with the help of charts, model, photographs or instruments: <ol style="list-style-type: none"><li>1. Light microscope</li><li>2. Binocular microscope</li><li>3. Phase contrast microscope</li><li>4. Fluorescent microscope</li><li>5. Inverted microscope</li><li>6. Microtome</li></ol>
Reference books	Practical Zoology by S. Lal
Teaching methodology	Laboratory work. Journal Preparation

[Subject code-2503000505045001]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester - V: Course: ZO-ME – 501: Biochemistry**

Course code	ZO-ME – 501						
Course title	Biochemistry						
Course level	200 – 299						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The Biochemistry course in Zoology aims to provide students with an understanding of the molecular and biochemical processes in animals, focusing on metabolic pathways, enzymes, and the role of biomolecules in physiological functions.						
Course objective	<ul style="list-style-type: none"> <li>• To explore the structure and function of biomolecules like proteins, lipids, and nucleic acids in animals.</li> <li>• To understand metabolic pathways and the regulation of biochemical processes in animal systems.</li> <li>• To examine the role of enzymes in metabolism and their importance in maintaining homeostasis.</li> </ul>						
Course outcomes	<p>CO1: Define biochemistry and explain its importance in biological processes and Describe water's structure and its role in biochemical reactions.</p> <p>CO2: Understand chemical bonding (covalent, ionic, hydrogen) and the role of pH and buffers in biology and Classify amino acids and explain protein structure and function.</p> <p>CO3: Classify carbohydrates and lipids, and explain their roles in energy storage and cellular functions and Describe DNA and RNA structure and their role in genetic information and protein synthesis.</p> <p>CO4: Apply thermodynamics to understand biochemical reactions and energy flow in metabolism.</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓	✓				
	CO2	✓	✓				
	CO3	✓	✓		✓	✓	✓
	CO4	✓		✓		✓	
Pre-requisite	Biology						
Course content	<b>UNIT 1 : Introduction to Biochemistry</b>						

Undergraduate Programme in Zoology as per NEP 2020[3 Years (Degree) & 4 Years (Honours/Honours with Research)]

*Handwritten signature/initials*

	<ul style="list-style-type: none"> <li>• Overview of Biochemistry: Definition, scope, and importance.</li> <li>• Water and its Role in Biochemistry: Structure and properties of water, hydrogen bonding, and its importance in biochemical processes</li> <li>• Atomic Structure and Chemical Bonding: Covalent and ionic bonds, van der Waals forces, hydrogen bonds.</li> <li>• Acid-Base Chemistry: pH, buffers, and their role in biological systems.</li> <li>• Thermodynamics in Biochemistry: Laws of thermodynamics</li> </ul> <p><b>UNIT 2: Biomolecules</b></p> <ul style="list-style-type: none"> <li>• Amino Acids: Structure, classification, and functions of amino acids as the building blocks of proteins.</li> <li>• Proteins: Structure of proteins (primary, secondary, tertiary, and quaternary), protein function, and denaturation.</li> <li>• Carbohydrates: Monosaccharides, disaccharides, polysaccharides, and their roles in energy storage and structure.</li> <li>• Lipids: Types of lipids (fats, phospholipids, and sterols) and their role in energy storage, membrane structure</li> <li>• Nucleic Acids: Structure of DNA and RNA, their roles in genetic information storage</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• Nelson &amp; Cox: Lehninger's Principles of Biochemistry: McMillan (2000)</li> <li>• Zubayet al: Principles of Biochemistry: WCB (1995)</li> <li>• Voet&amp;Voet: Biochemistry Vols 1 &amp; 2: Wiley (2004) 4.</li> </ul>
e-learning resources	<p>Swayam Portal</p> <p><a href="https://www.youtube.com/watch?v=JxK5rZxbyQY">https://www.youtube.com/watch?v=JxK5rZxbyQY</a></p> <p><a href="https://www.youtube.com/watch?v=vn1s9udYi8Q">https://www.youtube.com/watch?v=vn1s9udYi8Q</a></p> <p><a href="https://www.youtube.com/watch?v=2_p4hUFVK4Q">https://www.youtube.com/watch?v=2_p4hUFVK4Q</a></p> <p><a href="https://www.youtube.com/watch?v=S6LXyzZn5Ls">https://www.youtube.com/watch?v=S6LXyzZn5Ls</a></p> <p><a href="https://www.youtube.com/watch?v=0lZRAShqft0">https://www.youtube.com/watch?v=0lZRAShqft0</a></p>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment

[Subject Code-2503000505045002]

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester - V: Course: ZOP-ME-501: Practical in Biochemistry**

Course code	ZOP – ME – 501
Course title	Practical in Biochemistry
Course level	200 – 299
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The Biochemistry Practical course in Zoology aims to provide students with hands-on experience in biochemical techniques to analyze the molecular and metabolic processes in animals.
Course objective	<ul style="list-style-type: none"><li>• To develop practical skills in performing biochemical tests and analyzing animal tissues for biomolecules.</li><li>• To understand the enzymatic activities and metabolic pathways through laboratory experiments.</li><li>• To apply biochemical methods to study the physiological processes and health in animals.</li></ul>
Course content	<ol style="list-style-type: none"><li>1. To observe and identify different chemical bonds (covalent, ionic, hydrogen) in biological molecules.</li><li>2. To measure the pH of various solutions.</li><li>3. To perform qualitative tests for carbohydrates (Glucose, Fructose, Lactose, Starch).</li><li>4. To perform qualitative tests for lipids (Oil).</li><li>5. To perform qualitative tests for protein (Albumin)</li><li>6. To identify and distinguish between Purine and Pyrimidine bases.</li><li>7. To study structure of DNA and RNA with the help of charts.</li><li>8. To study different types of DNA with the help of charts / models.</li><li>9. To study different types of RNA with the help of charts / models.</li></ol>
Reference books	Principles and techniques of biochemistry and molecular biology Edition: 7 <sup>th</sup> by Wilson & Walker Varley's practical clinical biochemistry Edition: 6 <sup>th</sup> by Gowenlock, Alan
Teaching methodology	Laboratory work. Journal Preparation

*Handwritten signature*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

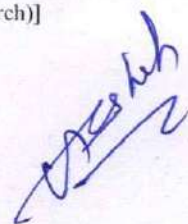
**Semester - V: Course: ZO-ME-502: Non-Chordates And Chordates - III**

Course code	ZO – ME – 502						
Course title	Non-Chordates And Chordates – III						
Course level	300 – 399						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The course on Chordate and Non-Chordate Zoology aims to provide students with a comprehensive understanding of the classification, structure, and evolutionary relationships of various invertebrate and vertebrate animals.						
Course objective	<ul style="list-style-type: none"> <li>• To explore the diverse anatomical and physiological features of chordates and non-chordates.</li> <li>• To understand the evolutionary significance and adaptations of these organisms.</li> <li>• To develop skills in identifying, classifying, and analyzing different species within these two major animal groups.</li> </ul>						
Course outcomes	<p>CO1: Learn about the importance of systematic, taxonomy and structural organization of animals and Getting familiarized with the morphology and anatomy of representatives of various animals' groups.</p> <p>CO2: Explain comparative account of different vertebrate skeletal systems; understand the pattern of evolution, structural organization and functions.</p> <p>CO3: Students recognize structural principles by studying all body systems of animal type and Know the behaviour pattern like parenting.</p> <p>CO4: Enhance collaborative learning and communication skills through practical sessions, team work and assignments and Practical curriculum includes museum specimens of various phyla and classes</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓	✓		✓		✓
	CO2	✓	✓	✓		✓	✓
	CO3		✓	✓	✓	✓	✓
	CO4	✓	✓	✓	✓	✓	✓

Pre-requisite	Biology, Basic Zoology and Classification
Course content	<p><b>UNIT 1 : Nonchordates</b></p> <p><b>1.1 Taxonomy of Nonchordates to be studied up to order</b></p> <ul style="list-style-type: none"> <li>• Protozoa</li> <li>• Porifera</li> <li>• Cnidaria</li> <li>• Helminthes</li> <li>• Annelida</li> </ul> <p><b>1.2 Study of the following animal types with reference to the Structure and functions of various organs of all systems: Leech</b></p> <ul style="list-style-type: none"> <li>• External features</li> <li>• Digestive system</li> <li>• Haemocoelomic system</li> <li>• Excretory system</li> <li>• Nervous system</li> <li>• Reproductive system</li> <li>• Parasitic adaptation</li> </ul> <p><b>UNIT 2 : Chordates</b></p> <p><b>2.1 Taxonomy of chordate to be studied up to order</b></p> <ul style="list-style-type: none"> <li>• Protochordata</li> <li>• Cyclostomata</li> <li>• Pisces</li> <li>• Amphibia</li> </ul> <p><b>2.2 Amplifications of chordates and Osteology</b></p> <p>Types of scales in Pisces Parental care in Pisces Neoteny in Amphibia Comparative study of vertebrates</p> <ul style="list-style-type: none"> <li>• Pectoral girdles</li> <li>• Pelvic girdle</li> <li>• Fore limbs</li> <li>• Hind limbs</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• A Text Book of General Biology - Tomer &amp; Singh. Rastogi Publication, Meerut</li> <li>• Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.</li> <li>• Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.</li> <li>• Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students, Asia Publishing Home.</li> <li>• Chordate Zoology E.L Jordan &amp; P. S. Verma. S.Chand</li> </ul>

*Dr. Ashish*

	<ul style="list-style-type: none"> <li>• Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.</li> <li>• Holland, P. (2011) The Animal Kingdom: A Very Short Introduction Oxford University Press.</li> <li>• Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw-Hill.</li> <li>• Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.</li> <li>• Modern Text Book of Zoology Prof. R. L. Kotpal Invertebrates Rastogi publication, 11<sup>th</sup> edition 2019-2020A</li> <li>• Outline of comparative anatomy of vertebrate Kingsley J.S. Central book depot, Allahabad</li> <li>• Parker and Haswell. Text Book of ZOOLOGY (Invertebrate)</li> <li>• PrushthvanshiPraniyoaneGarbhvidya - A.B.Vyas. Guj. GranthNirman Board.</li> <li>• Text Book of Invertebrates. Saras publication</li> <li>• Text Book of Chordates - A. Thangamani, S. Prasanna Kumar</li> <li>• Text book of Zoology - R. D. Vidyarthi. S.Chand</li> <li>• Text Book of Zoology - S.N. Prasad. Vikas Publishing House pvt.ltd. Delhi</li> <li>• The vertebrate Body by Romer Alfred Sherwood, Publisher: W, b, Saunders Company London.</li> <li>• UtkrushthaAprushthvanshiPraniyo - U.M.Rawal. Guj.Granthnirman Board.</li> <li>• Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.</li> </ul>
e-learning resources	<a href="http://egymkosh.ac.in/bitstream/123456789/16496/1/Unit-9.pdf">http://egymkosh.ac.in/bitstream/123456789/16496/1/Unit-9.pdf</a> <a href="https://biologywise.com/information-about-hydrostatic-skeleton">https://biologywise.com/information-about-hydrostatic-skeleton</a>
Teaching methodology	Class work, Discussion, Self Study, Projects, Seminars or/and Assignment



[Subject Code-2503000505055002]

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

### Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

#### Semester - V: Course: ZOP-ME-502:

#### Practical in Non-Chordates and Chordates - III

Course code	ZOP – ME – 502
Course title	Practical in Non-Chordates and Chordates – III
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The course on Chordate and Non-Chordate Practical Zoology aims to provide hands-on experience in the identification and study of various chordate and non-chordate species to enhance practical understanding of their anatomy and physiology.
Course objective	<ul style="list-style-type: none"><li>• To learn the identification techniques and classification of various species.</li><li>• To gain insights into the functional anatomy and adaptive features of these organisms through laboratory exercises.</li></ul>
Course content	<ol style="list-style-type: none"><li>1. Classification of following animals up to order:<ol style="list-style-type: none"><li>I. Protozoa: Ceratium, Entamoeba, Polystomella, Plasmodium, Opalina, Balantidium,</li><li>II. Porifera: Leucosolenia, Pheronema, Euspongia.</li><li>I. Cnidaria: Obelia, Millipora, Vaella, Rhizostoma, Tubipora, Alcyonium, Cerianthus, Pennatula, Adamsia, Zoanthus, Favia, Fungia, Astrea</li><li>IV. Platyhelminthes: Bipalium, Opisthorchis,</li><li>V. Nementhelminthes: Trichinella, Wacheria</li><li>VI Annelida: Sabella, Serpula, Arenicola, Acanthobdella,</li></ol></li><li>2. The following practical of <b>Leech</b> to be taught/studied only with the help of Charts/models/videos/photographs/permanent slides, working models, simulators etc.<ol style="list-style-type: none"><li>I. External features and Digestive system</li><li>II. Nervous system,</li><li>III. Reproductive system</li><li>IV. Mountings: Jaws, Salivary glands, Ovary and Testicular Nephridia</li></ol></li><li>3. Classification of following animals up to order:</li></ol>

*Handwritten signature*

	<p>I. Protochordates: Ciona, Doliolum and Salpa</p> <p>II. Cyclostomata: Bdelostoma</p> <p>III. Pisces: Sphyrna, (Skates), Harpodon, Clarius, Eel, Tetradon, Flute fish, Acipenser, Pterois and Lepidosiren/Neoceratodus</p> <p>IV. Amphibia: Ichthyophis, Necturus, Amphiuma, Alytes and Pipa</p> <p>4. Parental care in fishes :Gasterosteus, Rhodeus, Kurtus, Hippocampus/ Pipe fish, Tilapia and Skate (Mermaids purse)</p> <p>5. Types of scales in fishes: Placoid, Cycloid and Ctenoid</p> <p>6. Neoteny in Amphibia: Axolotal larva, Typhlomolge, Necturus</p> <p>7. Comparative study of osteology in vertebrates:</p> <ul style="list-style-type: none"> <li>• Pectoral girdles</li> <li>• Pelvic girdle</li> <li>• Fore limbs</li> <li>• Hind limbs</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• Vertebrate Zoology: An Experimental Field Approach-Nelson G. Hairston. Cambridge University Press, 1994</li> <li>• A Manual of Zoology Vol. I &amp; II – Ekambernath Ayar. S. Vishwanathan Chennai.</li> <li>• Practical Zoology by S. Lal</li> </ul>
Teaching methodology	Laboratory work. Journal Preparation

*Handwritten signature*

[Subject Code-2603000506015001]

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

### Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

#### Semester – VI: Course: ZO-MJ-601:

##### Animal Physiology and Endocrinology

Course Code	ZO – MJ – 601
Course title	Animal Physiology and Endocrinology
Course level	300 – 399
Credit	02
Total engagement	2 credits x 15 hrs. = 30 hrs.
Teaching per week	02 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The Animal Physiology and Endocrinology course aims to provide students with a thorough understanding of the physiological processes in animals, focusing on how various systems function and are regulated by hormones.
Course objective	<ul style="list-style-type: none"><li>• To study the mechanisms underlying animal physiological functions such as respiration, circulation, and digestion.</li><li>• To understand the role of hormones in regulating homeostasis and behavior.</li><li>• To analyze the interaction between different physiological systems and their endocrine regulation.</li></ul>
Course outcomes	<p>CO1: Understand the basic cellular and molecular mechanisms involved in nerve signaling and explain the functions of different cells of the nervous system.</p> <p>CO2: Understand the physiological mechanisms of synaptic transmission, sensory perception, and motor control. Describe the structure and function of the respiratory system. Understand the mechanics of gas exchange and transport of respiratory gases.</p> <p>CO3: Explain the regulation of respiration by neural, chemical, and mechanical factors. Differentiate and calculate the various parameters of lung capacity. Analyze characteristics of different endocrine glands and their secretions.</p> <p>CO4: Observe the structural and functional relationships amongst hypothalamus, pituitary and other glands. Examine the chemical classes of hormones and mechanism of hormone action. Establish a link between the normal vs pathophysiological conditions of endocrine organs and glands.</p>

*Handwritten signature*

Mapping between COs with PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
	CO1	✓	✓		✓		
	CO2	✓	✓	✓			
	CO3	✓	✓		✓		
	CO4	✓	✓		✓	✓	✓
Pre-requisite	Biology , Cell Biology, Basic Zoology						
Course content	<p><b>Unit: 1(A). Animal Physiology</b>  Introduction to Respiratory Physiology</p> <ul style="list-style-type: none"> <li>• Overview of human respiratory system</li> <li>• Aquatic &amp; terrestrial respiratory organs and structures.</li> </ul> <p>Exchange of gases</p> <ul style="list-style-type: none"> <li>• Exchange of respiratory gases</li> <li>• External respiration &amp; Internal respiration</li> <li>• Partial pressures of gases (O<sub>2</sub>, CO<sub>2</sub>)</li> <li>• Gas laws- Dalton's Law and Henry's law.</li> </ul> <p>Transport of Gases</p> <ul style="list-style-type: none"> <li>• Transport of oxygen</li> <li>• Transport of carbon-di-oxide.</li> <li>• O<sub>2</sub> dissociation Curve</li> </ul> <p>Regulation of Respiration</p> <ul style="list-style-type: none"> <li>• Neural control of respiration: brainstem centers (medulla, pons)</li> <li>• Role of chemoreceptors in regulation (central and peripheral)</li> </ul> <p>Respiratory pigments: Distribution; composition; properties; Functions, Respiratory quotient</p> <p><b>Unit: 1(B). Animal Physiology</b>  Introduction to Nervous System Physiology</p> <ul style="list-style-type: none"> <li>• Neurons: structure, types, and functions</li> <li>• Neuroglial cells and their roles in the nervous system</li> <li>• Resting membrane potential and ion gradients</li> </ul> <p>Action Potentials and Signal Transmission</p> <ul style="list-style-type: none"> <li>• Ion channels and action potential generation</li> <li>• Propagation of action potentials &amp; Refractory period</li> </ul> <p>Synaptic Transmission</p> <ul style="list-style-type: none"> <li>• Synapse: Structure and types (Chemical and Electric).</li> <li>• Neurotransmitter release, receptors, and signal transduction</li> <li>• Excitatory and inhibitory postsynaptic potentials (EPSPs and IPSPs)</li> </ul> <p>Structure and function of sense organs</p> <ul style="list-style-type: none"> <li>• Human eye and</li> <li>• Human ear</li> </ul> <p><b>Unit : 2 Endocrinology</b></p> <ul style="list-style-type: none"> <li>• An overview of vertebrate endocrine system. Structural features</li> </ul>						

*Handwritten signature*

	<p>and hormones of endocrine glands- hypothalamus, pituitary, pineal, thyroid, parathyroid, GI tract, pancreatic islets, adrenals and gonads.</p> <ul style="list-style-type: none"> <li>• General classes of hormones: Peptide, Thyroid, Steroid, Neuro transmitters, Neuropeptides, Chalcones, Peptide-growth stimulating factors, Eicosanoids and pheromones</li> <li>• Hormones and endocrine glands: Synthesis and control of synthesis, Storage, Metabolism and functions.</li> <li>• Mechanisms of hormone action: Receptors and types- Membrane receptors, Nuclear receptors; Receptor regulation and signal transduction, Second messengers, Permissive actions of hormones and termination of hormone action.</li> <li>• Pathophysiology of hypothalamic, pituitary, pineal, thyroid, parathyroid, GI tract, pancreatic islets, adrenal and gonadal hormones.</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• K Sembulingam - Essentials of Medical Physiology</li> <li>• Sherwood - Human Physiology From Cells to Systems</li> <li>• Principles of Anatomy &amp; Physiology, 2006, 11th Edition, Tortora G.J. &amp; Grabowski S., John Wiley &amp; sons, Inc.</li> <li>• Human physiology, Vol. I &amp; II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical appliedagency, Kolkata</li> <li>• Text book of Animal Physiology, 2008, 2nd Edn. Nagabhushanam, S. V. S. Rana, S.Kalavathy, Oxford University Press, India.</li> <li>• Textbook of Practical Physiology, 2001, G.K.Pal, Pravati Pal: Orient Longman</li> </ul>
e-learning resources	<p><a href="https://bio.libretexts.org/Learning_Objects/Worksheets/Book%3A_The_Biology_Corner_(Worksheets)/Anatomy_Worksheets/Investigation%3A_Measuring_Lung_Capacity">https://bio.libretexts.org/Learning_Objects/Worksheets/Book%3A_The_Biology_Corner_(Worksheets)/Anatomy_Worksheets/Investigation%3A_Measuring_Lung_Capacity</a>  <a href="https://www.ncbi.nlm.nih.gov/books/NBK482414/">https://www.ncbi.nlm.nih.gov/books/NBK482414/</a>  <a href="https://egyankosh.ac.in/bitstream/123456789/7545/1/Unit-12.pdf">https://egyankosh.ac.in/bitstream/123456789/7545/1/Unit-12.pdf</a>  <a href="https://egyankosh.ac.in/bitstream/123456789/81597/1/PRACTICAL%20MANUAL.pdf">https://egyankosh.ac.in/bitstream/123456789/81597/1/PRACTICAL%20MANUAL.pdf</a>  <a href="https://egyankosh.ac.in/bitstream/123456789/81429/3/Block-1.pdf">https://egyankosh.ac.in/bitstream/123456789/81429/3/Block-1.pdf</a>  <a href="https://youtu.be/0GSRbmcNh3A?si=eWjvYup6u6s5HouV">https://youtu.be/0GSRbmcNh3A?si=eWjvYup6u6s5HouV</a>  <a href="https://youtube.com/playlist?list=PL6rxSTf9Noel_xTWGiGgXhfqT21UesHHI&amp;si=hL9RpVHsU4N1zQcB">https://youtube.com/playlist?list=PL6rxSTf9Noel_xTWGiGgXhfqT21UesHHI&amp;si=hL9RpVHsU4N1zQcB</a>  <a href="https://youtu.be/fgXmffCyxco?si=RteQFv83XbV6xCqh">https://youtu.be/fgXmffCyxco?si=RteQFv83XbV6xCqh</a>  <a href="https://youtu.be/-vOJXUx1oE0?si=RiAtP-SAvO9xsqd">https://youtu.be/-vOJXUx1oE0?si=RiAtP-SAvO9xsqd</a>  <a href="https://youtu.be/w5DItm5RU_Q?si=diNevOH7kOo8pWDr">https://youtu.be/w5DItm5RU_Q?si=diNevOH7kOo8pWDr</a></p>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment


*Handwritten signature/initials in blue ink.*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester – VI: Course: ZOP-MJ-601:****Practical in Animal Physiology and Endocrinology**

Course code	ZOP – MJ – 601
Course title	Practical in Animal Physiology and Endocrinology
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The Animal Physiology and Endocrinology Practical course aims to provide students with hands-on experience in studying the physiological processes and hormonal functions in animals through laboratory experiments and observations.
Course objective	<ul style="list-style-type: none"> <li>• To conduct experiments that demonstrate key physiological functions like respiration, circulation, and digestion.</li> <li>• To analyze endocrine responses and hormonal regulation through practical techniques.</li> <li>• To develop skills in data collection, interpretation, and analysis of physiological and endocrinological phenomena.</li> </ul>
Course content	<ol style="list-style-type: none"> <li>1. To study aquatic &amp; terrestrial respiratory organs and structures</li> <li>2. To study the rate of oxygen consumption of Albino rat or black rat. (With a help of video/chart)</li> <li>3. To perform a practical on lung capacity: Tidal Volume (TV), Inspiratory Reserve Volume (IRV), Expiratory Reserve Volume (ERV) and Vital Capacity (VC) etc.</li> <li>4. To study different types of neurons and Neuroglia cells.</li> <li>5. To study Synapse: Structure and types (Chemical and Electric).</li> <li>6. To study Nerve Conduction Velocity measurements. (Nerve stimulator machine)</li> <li>7. To study structure and function of sense organs: (i) Human eye and (ii) Human ear</li> <li>8. Hormonal control and regulation of glands: Pituitary gland, Thyroid gland, Parathyroid gland,</li> <li>9. Histological observations of endocrine glands</li> <li>10. Study of pathology of endocrine glands</li> </ol>



Reference books	<ul style="list-style-type: none"><li>• Experimental Physiology, 2005, S. C. Rastogi: New Age International Publishers.</li></ul>
Teaching methodology	Laboratory work. Journal Preparation

*Cash*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester – VI: Course: ZO-MJ-602: Non-Chordates And Chordates – IV**

Course code	ZO – MJ – 602						
Course title	Non-Chordates And Chordates – IV						
Course level	300 – 399						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The course on Chordate and Non-Chordate Zoology aims to provide students with a comprehensive understanding of the classification, structure, and evolutionary relationships of various invertebrate and vertebrate animals.						
Course objective	<ul style="list-style-type: none"> <li>• To explore the diverse anatomical and physiological features of chordates and non-chordates.</li> <li>• To understand the evolutionary significance and adaptations of these organisms.</li> <li>• To develop skills in identifying, classifying, and analyzing different species within these two major animal groups.</li> </ul>						
Course outcomes	<p>CO1: Identified the taxonomic status up to order level of higher invertebrates and vertebrates.</p> <p>CO2: Learn about the importance of systematics, taxonomy and structural organization of animals.</p> <p>CO3: Understand to analyse and critically the structure and functions of various system of higher non chordate and chordates animal.</p> <p>CO4: Enhance collaborative learning and communication skills through practical sessions, team work and assignments. Practical curriculum includes museum specimens of various phyla and classes.</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓			✓		✓
	CO2	✓	✓		✓	✓	✓
	CO3	✓	✓		✓	✓	✓
	CO4	✓	✓	✓	✓	✓	✓
Pre-requisite	Biology, Basic Zoology						
Course content	<b>Unit : 1 Nonchordates</b>						



	<p><b>1.1 Taxonomy of Nonchordates to be studied up to order</b></p> <ul style="list-style-type: none"> <li>• Arthropoda</li> <li>• Mollusca</li> <li>• Echinodermata</li> <li>• Hemichordata</li> </ul> <p><b>1.2 Study of the following animal types with reference to the Structure and functions of various organs of all systems: Sepia</b></p> <ul style="list-style-type: none"> <li>• External features</li> <li>• Digestive system</li> <li>• Respiratory system</li> <li>• Circulatory system</li> <li>• Excretory system</li> <li>• Nervous system</li> <li>• Reproductive system</li> </ul> <p><b>Unit : 2. Chordates</b></p> <p><b>2.1 Taxonomy of chordate to be studied up to order</b></p> <ul style="list-style-type: none"> <li>• Reptiles</li> <li>• Aves</li> <li>• Mammals</li> </ul> <p><b>2.2 Study of the following animal types with reference to the Structure and functions of various organs of all systems: Pigeon.</b></p> <ul style="list-style-type: none"> <li>• External Characters</li> <li>• Digestive system</li> <li>• Respiratory system (Air sacs)</li> <li>• Circulatory system (Heart, Arterial system and Venous system)</li> <li>• Urinogenital system</li> <li>• Brain</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• A Manual of Zoology Vol. I &amp; II - EkambernathAyar. S. Vishwanathan Chennai.</li> <li>• A Text Book of General Biology - Tomer&amp; Singh. Rastogi Publication, Meerut</li> <li>• Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.</li> <li>• Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.</li> <li>• Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students, Asia Publishing Home.</li> <li>• Chordate Zoology E.L Jordan &amp; P. S. Verma. S.Chand</li> <li>• Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal</li> <li>• Diversity, McGraw-Hill.</li> </ul>

*Handwritten signature*

	<ul style="list-style-type: none"> <li>• Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.</li> <li>• Modern Text Book of Zoology Prof. R. L. Kotpal Invertebrates Rastogi publication, 11<sup>th</sup> edition 2019-2020A</li> <li>• PrushthvanshiPraniyoaneGarbhvidya - A.B.Vyas. Guj. GranthNirman Board.</li> <li>• Text Book of Invertebrates. Saras publication</li> <li>• Text Book of Chordates - A. Thangamani, S. Prasanna Kumar</li> <li>• Text book of Zoology - R. D. Vidyarthi. S.Chand</li> <li>• Text Book of Zoology - S.N. Prasad. Vikas Publishing House pvt.ltd. Delhi</li> <li>• The vertebrate Body by Romer Alfred Sherwood, Publisher: W, b, Saunders Company London.</li> <li>• UtkrushthaAprushthvanshiPraniyo - U. M. Rawal. Guj.GranthNirman Board.</li> <li>• Vertebrate Zoology: An Experimental Field Approach-Nelson G.Hairston. Cambridge University Press, 1994</li> <li>• Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.</li> </ul>
e-learning resources	<a href="http://egymkosh.ac.in/bitstream/123456789/16496/1/Unit-9.pdf">http://egymkosh.ac.in/bitstream/123456789/16496/1/Unit-9.pdf</a> <a href="http://www.notesonzooology.com/invertebrates/locomotion/locomotion-in-star-fish-">http://www.notesonzooology.com/invertebrates/locomotion/locomotion-in-star-fish-</a> <a href="https://biologywise.com/information-about-hydrostatic-skeleton">https://biologywise.com/information-about-hydrostatic-skeleton</a>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment



**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester – VI: Course: ZOP-MJ-602:****Practical in Non-Chordates and Chordates - IV**

Course code	ZOP – MJ – 602
Course title	Practical in Non-Chordates and Chordates – IV
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The course on Chordate and Non-Chordate Practical Zoology aims to provide hands-on experience in the identification and study of various chordate and non-chordate species to enhance practical understanding of their anatomy and physiology.
Course objective	<ul style="list-style-type: none"> <li>• To learn the identification techniques and classification of various species.</li> <li>• To gain insights into the functional anatomy and adaptive features of these organisms through laboratory exercises.</li> </ul>
Course content	<p>1. Classification of following animals up to order:</p> <p>I. Arthropoda: Apus, Daphnia, Cyclops, Cypris, Squilla, Hippa, Sacculina, Mantis, Dragon fly, Ear-wig, Mosquito, Ant, Beetle, Tick, Mite,</p> <p>II. Mollusca: Heliotis, Patella, Nautilus, Oyster, Mytilus, Doris, Cypraea, Teredo, Solen, Octopus, Loligo,</p> <p>III. Echinodermata: Astropecten, Strongylocentrotus, Synapta, Sand-dollar, Holothuria,</p> <p>IV. Hemichordata: Saccoglossus and Rhabdopleura</p> <p>2. The following practicals of <b>Sepia</b> to be studied/taught only with the help of charts, models, Videos, photographs, permanent slides, working models, simulators etc.</p> <ul style="list-style-type: none"> <li>• Digestive system</li> <li>• Nervous system</li> <li>• Mountings: Jaws, Radula, Chromatophores and Spermatophores</li> </ul> <p>3. Classification of following animals up to order:</p> <p>I. Reptiles: Trionyx, Sphenodon, Gecko, Eryx, Krait and Alligator</p>

	<p>II. Aves: Parrot, Great Indian Bustard, Horned owl, Flamingo, Emu</p> <p>III. Mammals: Ornithorhynchus, Didelphys, Erinaceus, Seal, Mongoose, Loris, Rabbit and Rhesus monkey</p> <p>4. The following practical of <b>Pigeon</b> to be taught/studied only with the help of Charts/models/videos/photographs/permanent slides, working models, simulators etc.</p> <ul style="list-style-type: none"> <li>• Digestive system</li> <li>• Urinogenital system,</li> <li>• Brain</li> <li>• Mountings: Pecten and Hyoid apparatus</li> </ul> <p>5. Types of feathers in birds</p>
Reference books	<ul style="list-style-type: none"> <li>• Vertebrate Zoology: An Experimental Field Approach-Nelson G.Hairston. Cambridge University Press, 1994</li> <li>• A Manual of Zoology Vol. I &amp; II - Ekambarnath Ayar. S. Vishwanathan Chennai.</li> <li>• Practical Zoology by S. Lal</li> </ul>
Teaching methodology	Laboratory work. Journal Preparation

*Handwritten signature*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester – VI: Course: ZO-MJ-603:****Bhartiya Gyan Parampara in Zoology – II – BGP**

Course code	ZO – MJ – 603						
Course title	Bhartiya Gyan Parrampara in Zoology – II – BGP						
Course level	300 – 399						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	This course aims to explore the cultural, mythological, and scientific significance of serpents, insects, and birds within Indian Knowledge Systems, highlighting their roles in tradition, medicine, and spirituality.						
Course objective	<ul style="list-style-type: none"> <li>To understand the mythological and cultural symbolism of serpents in Indian traditions.</li> <li>To explore the role of serpents, insects, and birds in Ayurveda, Kundalini yoga, and traditional ecological practices.</li> <li>To examine the relevance of ancient knowledge systems in contemporary environmental and medical practices.</li> </ul>						
Course outcomes	<p>CO1: Explain the fundamental principles and importance of Indian Knowledge Systems in the context of Zoology. Compare and contrast the ancient Indian classification of animals with modern taxonomic systems.</p> <p>CO2: Analyze the scientific basis behind the classification of animals into various Vargas according to Vedic literature.</p> <p>CO3: Evaluate the cultural, spiritual, and ecological significance of cows in Indian tradition and compare their status across different religions.</p> <p>CO4: Interpret the symbolism of animals (particularly snakes) in Indian mythology, spiritual practices, and traditional medicine. Apply traditional knowledge about animals to address contemporary challenges in conservation, sustainable development, and Ecological balance.</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓	✓	✓	✓		✓
	CO2	✓	✓	✓	✓		✓

	CO3	✓	✓	✓	✓	✓	✓
	CO4	✓	✓	✓	✓	✓	✓
Pre-requisite	Biology, Zoology						
Course content	<p><b>Unit : 1 Serpent Science in Indian Tradition</b></p> <p>Mythological Significance of Snakes</p> <ul style="list-style-type: none"> <li>• Symbolism of Sheshanaga, Vasuki, and other serpent deities</li> <li>• Naga worship traditions across India</li> <li>• Astronomical connections of serpent mythology</li> <li>• Cultural practices related to snake worship</li> </ul> <p>Serpents in Kundalini Yoga</p> <ul style="list-style-type: none"> <li>• Concept of Kundalini Shakti as serpent energy</li> <li>• Relationship between nadis (energy channels) and serpent imagery</li> <li>• Practical aspects of awakening consciousness</li> <li>• Scientific interpretations of Kundalini experiences</li> </ul> <p>Snakes in Ayurveda</p> <ul style="list-style-type: none"> <li>• Traditional knowledge of snake venom and its medicinal uses</li> <li>• Ayurvedic treatments for snake bites</li> <li>• Snake-based preparations in traditional medicine</li> <li>• Ethical aspects of using animal products in medicine</li> </ul> <p>Dual thinking of Snakes in Indian Tradition</p> <ul style="list-style-type: none"> <li>• Key for identification of venomous and non-venomous snakes</li> <li>• Positive symbolism: Wisdom, eternity, and protection</li> <li>• Regional variations in serpent symbolism</li> <li>• Contemporary relevance of serpent symbolism</li> <li>• Venomous and non-venomous snakes of Gujarat</li> </ul> <p><b>Unit: 2 Subject Specific IKS – Insects in Indian Knowledge Systems</b></p> <p>Insects in Indian Knowledge Systems</p> <ul style="list-style-type: none"> <li>• Sericulture and apiculture traditions</li> <li>• Insect-based traditional medicines</li> <li>• Pest management in traditional agriculture</li> <li>• Seasonal insect cycles documented in traditional almanacs</li> </ul> <p>Traditional Knowledge of Birds</p> <ul style="list-style-type: none"> <li>• Bird classification in Sanskrit texts</li> <li>• Migratory patterns observed in ancient India</li> <li>• Bird symbolism in Indian art and literature</li> </ul> <p>Traditional bird conservation practices</p>						

*Handwritten signature*

Reference books	<ul style="list-style-type: none"> <li>• Economic Zoology: G. S. Shukla &amp; V. B. Upadhyay, Rastogi Publication, Meerut.</li> <li>• Economic and Applied Entomology: Kumar and Nigum, Emkay Publication, Delhi.</li> <li>• Modern Text Book of Zoology (invertebrate) R.L. Kotpal, Rastogi Publication, Meerut, India.</li> <li>• Invertebrate Zoology- E.L. Jordan &amp; P.S. Verma</li> <li>• Invertebrate Zoology- T.C. Majumuria, Pradeep Publication, Jalandhar,</li> </ul>
e-learning resources	<p>Swayam Portal</p> <p><a href="https://www.hinduwebsite.com/buzz/symbolism-of-snakes-in-hinduism.asp">https://www.hinduwebsite.com/buzz/symbolism-of-snakes-in-hinduism.asp</a></p> <p><a href="https://en.wikipedia.org/wiki/Snake_worship">https://en.wikipedia.org/wiki/Snake_worship</a></p> <p><a href="https://www.astroved.com/blogs/why-are-snakes-considered-sacred-in-hinduism">https://www.astroved.com/blogs/why-are-snakes-considered-sacred-in-hinduism</a></p> <p><a href="https://en.wikipedia.org/wiki/Snakes_in_mythology">https://en.wikipedia.org/wiki/Snakes_in_mythology</a></p> <p><a href="https://timesofindia.indiatimes.com/etimes/trending/7-snake-deities-that-are-worshipped-in-india-and-why/photostory/111843516.cms">https://timesofindia.indiatimes.com/etimes/trending/7-snake-deities-that-are-worshipped-in-india-and-why/photostory/111843516.cms</a></p> <p><a href="https://timesofindia.indiatimes.com/etimes/trending/7-snake-deities-that-are-worshipped-in-india-and-why/amp_etphotostory/111843516.cms">https://timesofindia.indiatimes.com/etimes/trending/7-snake-deities-that-are-worshipped-in-india-and-why/amp_etphotostory/111843516.cms</a></p> <p><a href="https://www.karigarofficial.com/blogs/blog/symbolism-and-importance-of-snakes-in-hinduism-ayurveda-and-mythology">https://www.karigarofficial.com/blogs/blog/symbolism-and-importance-of-snakes-in-hinduism-ayurveda-and-mythology</a></p> <p><a href="https://en.wikipedia.org/wiki/N%C4%81ga">https://en.wikipedia.org/wiki/N%C4%81ga</a></p> <p><a href="https://en.wikipedia.org/wiki/Serpent_symbolism">https://en.wikipedia.org/wiki/Serpent_symbolism</a></p> <p><a href="https://openknowledge.fao.org/server/api/core/bitstreams/54bfbee7-88e4-4a96-8029-d12fb5266a2f/content">https://openknowledge.fao.org/server/api/core/bitstreams/54bfbee7-88e4-4a96-8029-d12fb5266a2f/content</a></p> <p><a href="https://www.vedantu.com/biology/apiculture-and-sericulture">https://www.vedantu.com/biology/apiculture-and-sericulture</a></p> <p><a href="https://byjus.com/biology/difference-between-apiculture-and-sericulture/">https://byjus.com/biology/difference-between-apiculture-and-sericulture/</a></p> <p><a href="https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf">https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf</a></p> <p><a href="https://www.gktoday.in/sericulture-apiculture-and-poultry/">https://www.gktoday.in/sericulture-apiculture-and-poultry/</a></p> <p><a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC4561416/">https://pmc.ncbi.nlm.nih.gov/articles/PMC4561416/</a></p> <p><a href="https://www.britannica.com/place/India/Agriculture-and-animal-husbandry">https://www.britannica.com/place/India/Agriculture-and-animal-husbandry</a></p> <p><a href="https://www.fao.org/3/bp265e/bp265e.pdf">https://www.fao.org/3/bp265e/bp265e.pdf</a></p>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment

*Handwritten signature*

[Subject Code-2603000506035002]

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

### Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

#### Semester – VI: Course: ZOP-MJ-603:

#### Practical in Bhartiya Gyan Parampara in Zoology – II - BGP

Course code	ZOP – MJ – 603
Course title	Practical in Bhartiya Gyan Parampara in Zoology – II – BGP.
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The practical course aims to provide hands-on experience in studying the cultural, medicinal, and ecological aspects of serpents, insects, and birds, based on traditional Indian Knowledge Systems.
Course objective	<ul style="list-style-type: none"><li>• To develop practical skills in identifying and understanding the symbolic and medicinal uses of serpents, insects, and birds.</li><li>• To explore traditional methods of sericulture, apiculture, and pest management through practical activities.</li><li>• To engage with field-based observations and conservation practices related to these species in Indian culture.</li></ul>
Course content	<ol style="list-style-type: none"><li>1. To study 7 snake deities that are worshipped in India: Sheshanaga, Vasuki, Karkotaka, Takshaka, Kaliya, Manasa, Gullika</li><li>2. To study Key for identification of venomous and non-venomous snakes.</li><li>3. To study species of honeybees commonly found in India.</li><li>4. To study social organization of honey bees.</li><li>5. To study medicinal importance of honey, bee wax, bees venom.</li><li>6. To study types of silkworm.</li><li>7. To study bird symbolism in Indian art and literature: Eagle, Crane, Peacock, Crow, Sparrow, Falcon, Owl, Swan, Pelican, Penguin, Bluebird, Quail, Nightingale, Hummingbird, Cardinal, Chickadee, Woodpecker, Dove, Heron, Blackbird.</li><li>8. To study birds in Indian culture: Eagle, Peacock, Vulture, Owl, Crow, Crane, Swan, Chukar, Pigeon, Parakeet, Cuckoo, Indian Roller, Rooster.</li></ol>
Reference books	<ul style="list-style-type: none"><li>• Practical Zoology by S. Lal</li></ul>
Teaching methodology	Laboratory work. Journal Preparation

*Handwritten signature*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT****Undergraduate Program in Zoology (B. Sc.)**

(3 Years Degree; 4 Years Honours/Honours with Research)

**Semester – VI: Course: ZO-ME – 601: Animal Physiology**

Course code	ZO-ME – 601						
Course title	Animal Physiology						
Course level	200 – 299						
Credit	02						
Total engagement	2 credits x 15 hrs. = 30 hrs.						
Teaching per week	02 hrs.						
Minimum weeks per semester	15						
Effective from	2025-26						
Purpose of course	The Animal Physiology course in Zoology aims to provide students with a detailed understanding of the physiological processes and systems that regulate animal functions, from cellular to organism levels.						
Course objective	<ul style="list-style-type: none"> <li>To explore the structure and function of various organ systems in animals.</li> <li>To understand the mechanisms of homeostasis and regulation within animal bodies.</li> </ul>						
Course outcomes	<p>CO1: Describe the structure and function of the digestive system and its role in nutrient absorption. Explain the digestion and absorption of carbohydrates, proteins, and fats, and the enzymes involved.</p> <p>CO2: Understand the structure and function of the cardiovascular system and its circulation processes. Describe the cardiac cycle, blood pressure regulation, and gas transport in the blood.</p> <p>CO3: Explain kidney structure and function, focusing on filtration, reabsorption, and secretion. Understand the respiratory system's structure and function in gas exchange and breathing.</p> <p>CO4: Integrate knowledge of the digestive, cardiovascular, renal, and respiratory systems in maintaining homeostasis.</p>						
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	✓	✓				
	CO2	✓	✓	✓			✓
	CO3	✓	✓	✓	✓		
	CO4	✓			✓		✓
Pre-requisite	Biology, Cell biology, Zoology						
Course content	<b>Unit : 1(A) Digestive System</b> <ul style="list-style-type: none"> <li>Structure and function of the digestive tract (mouth, stomach, small and large intestine)</li> </ul>						

	<ul style="list-style-type: none"> <li>• Digestion and absorption of nutrients (carbohydrates, proteins, fats)</li> <li>• Enzymes involved in digestion</li> </ul> <p><b>Unit : 1(B) Circulatory System</b></p> <ul style="list-style-type: none"> <li>• Structure and function of the heart, blood vessels, and blood</li> <li>• Cardiac cycle and blood pressure regulation</li> <li>• Circulation (systemic, pulmonary)</li> <li>• Blood composition (plasma, red blood cells, white blood cells, platelets)</li> <li>• Mechanisms of oxygen and carbon dioxide transport</li> </ul> <p><b>Unit : 2 (A) Excretory System</b></p> <ul style="list-style-type: none"> <li>• Structure and function of kidneys</li> <li>• Structure and function of Nephron</li> <li>• Filtration, reabsorption, and secretion in nephron</li> </ul> <p><b>Unit : 2 (B) Respiratory System</b></p> <ul style="list-style-type: none"> <li>• Structure and function of the respiratory system (lungs, trachea, bronchi)</li> <li>• Mechanism of breathing (inspiration and expiration)</li> <li>• Gas exchange and transport (oxygen and carbon dioxide)</li> </ul>
Reference books	<ul style="list-style-type: none"> <li>• K Sembulingam - Essentials of Medical Physiology</li> <li>• Sherwood - Human Physiology From Cells to Systems</li> <li>• Principles of Anatomy &amp; Physiology, 2006, 11th Edition, Tortora G.J. &amp; Grabowski S., John Wiley &amp; sons, Inc.</li> <li>• Human physiology, Vol. I &amp; II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical appliedagency, Kolkata</li> <li>• Text book of Animal Physiology, 2008, 2nd Edn. Nagabhushanam, S. V. S. Rana, S.Kalavathy, Oxford University Press, India.</li> <li>• Textbook of Practical Physiology, 2001, G.K.Pal, Pravati Pal: Orient Longman</li> <li>• Experimental Physiology, 2005, S.C. Rastogi: New Age International Publishers.</li> </ul>
e-learning resources	<p><a href="https://bio.libretexts.org/Learning_Objects/Worksheets/Book%3A_The_Biology_Corner_(Worksheets)/Anatomy_Worksheets/Investigation%3A_Measuring_Lung_Capacity">https://bio.libretexts.org/Learning_Objects/Worksheets/Book%3A_The_Biology_Corner_(Worksheets)/Anatomy_Worksheets/Investigation%3A_Measuring_Lung_Capacity</a></p> <p><a href="https://www.ncbi.nlm.nih.gov/books/NBK482414/">https://www.ncbi.nlm.nih.gov/books/NBK482414/</a></p> <p><a href="https://egyankosh.ac.in/bitstream/123456789/7545/1/Unit-12.pdf">https://egyankosh.ac.in/bitstream/123456789/7545/1/Unit-12.pdf</a></p> <p><a href="https://egyankosh.ac.in/bitstream/123456789/81597/1/PRACTICAL%20MANUAL.pdf">https://egyankosh.ac.in/bitstream/123456789/81597/1/PRACTICAL%20MANUAL.pdf</a></p> <p><a href="https://egyankosh.ac.in/bitstream/123456789/81429/3/Block-1.pdf">https://egyankosh.ac.in/bitstream/123456789/81429/3/Block-1.pdf</a></p> <p><a href="https://youtu.be/0GSRbmcNh3A?si=eWjvYup6u6s5HouV">https://youtu.be/0GSRbmcNh3A?si=eWjvYup6u6s5HouV</a></p> <p><a href="https://youtube.com/playlist?list=PL6rxSTt9Noel_xTWGiGgXhfqT21UesHHI&amp;si=hL9RpVHsU4N1zQcB">https://youtube.com/playlist?list=PL6rxSTt9Noel_xTWGiGgXhfqT21UesHHI&amp;si=hL9RpVHsU4N1zQcB</a></p>

*Handwritten signature*

	<a href="https://youtu.be/fgXmffCyxco?si=RteQF83XbV6xCqh">https://youtu.be/fgXmffCyxco?si=RteQF83XbV6xCqh</a> <a href="https://youtu.be/-vOJXUx1oE0?si=RiAtP-SAyO9xsqd">https://youtu.be/-vOJXUx1oE0?si=RiAtP-SAyO9xsqd</a> <a href="https://youtu.be/w5DItm5RU_Q?si=diNevOH7kOo8pWDr">https://youtu.be/w5DItm5RU_Q?si=diNevOH7kOo8pWDr</a>
Teaching methodology	Class work, Discussion, Self-Study, Projects, Seminars or/and Assignment

*SSS*

[Subject Code-2603000506045002]

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

### Undergraduate Program in Zoology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

#### Semester – VI: Course: ZOP-ME-601: Practical in Animal Physiology

Course code	ZOP – ME – 601
Course title	Practical in Animal Physiology
Course level	300 – 399
Credit	02
Total engagement	2 credits x 30 hrs. = 60 hrs.
Teaching per week	04 hrs.
Minimum weeks per semester	15
Effective from	2025-26
Purpose of course	The Animal Physiology Practical course aims to provide hands-on experience in studying the physiological functions of animals through experiments, dissections, and observation of various organ systems.
Course objective	<ul style="list-style-type: none"><li>• To develop practical skills in observing and analyzing physiological processes like respiration, circulation, and digestion.</li><li>• To perform experiments to understand the mechanisms of homeostasis and regulation in animals.</li><li>• To interpret experimental data and relate it to the theoretical concepts of animal physiology.</li></ul>
Course content	<ol style="list-style-type: none"><li>1. To study the structure of the digestive tract (mouth, stomach, small and large intestine) using models or histology slides.</li><li>2. To observe the digestion and absorption of nutrients (carbohydrates, proteins, and fats) in various conditions and identify the role of digestive enzymes.</li><li>3. To study the structure and function of the heart and blood vessels using anatomical models or histological slides.</li><li>4. To study systemic and pulmonary circulation through charts.</li><li>5. To determine the composition of blood through blood smear preparation and staining.</li><li>6. To examine the structure and function of the kidneys and nephrons using histology slides or kidney models.</li><li>7. To study the structure and function of the respiratory system (lungs, trachea, bronchi) using anatomical models/ charts.</li><li>8. To measure respiratory rates to understand the mechanism of breathing (inspiration and expiration).</li><li>9. To study gas exchange and transport (oxygen and carbon dioxide) with the help of charts.</li></ol>

Reference books	<ul style="list-style-type: none"><li>• Practical Zoology by S. Lal</li></ul>
Teaching methodology	Laboratory work. Journal Preparation

*Handwritten signature*