

**The Kelkar Education Trust's**  
**V. G. Vaze College of Arts, Science and Commerce**  
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**NEP FRAMEWORK FOR S.Y.B.Sc. ZOOLOGY 2024-25 ONWARDS**

SEMESTER	COURSE	CREDITS	
III	<b>Major</b> Paper I (credits 2) : Introduction to Molecular Genetics Paper II (credits 2) : Fundamentals of Life Processes Paper III (credits 2) : Applied Zoology  Practical based on Paper I, II, and III (credits 2)	08 Credits (6L+2P)	
	<b>Minor</b> Paper III (2 credits) : Applied Zoology  Practical based on Paper III (credits 2)	04 Credits (2L+2P)	
	<b>VSC</b> : Ornithology and Entomology Practical based on VSC (credits 2)	02 Credits (2P)	
	Field Project	02 Credits	
	OE for Arts : Science of evolution	02 Credits (2L)	
IV	<b>Major</b> Paper I (credits 2) : Evolution and Scientific attitude Paper II (credits 2) : Cell Biology Paper III (credits 2) : Embryology, Reproduction and Pollution  Practical based on Paper I, II, and III (credits 2)	08 Credits (6L+2P)	
	<b>Minor</b> Paper III (2 credits) : Embryology, Reproduction and Pollution  Practical based on Paper III (credits 2)	04 Credits (2L+2P)	
	<b>SEC</b> : Human Pathology Practical based on SEC (credits 2)	02 Credits (2P)	
	OE for Arts : Anthrozoology	02 Credits (2L)	



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NEP Syllabus for S.Y.B.Sc.  
(June 2024 Onwards)  
Program: B.Sc.  
Semester – III and IV  
Course: Zoology

**Semester III**

Course Code	Paper Title	Credit
VGUSMZ0301	Introduction to Molecular Genetics	02
VGUSMZ0302	Fundamentals of Life Processes	02
VGUSMNZO303	Applied Zoology	02
VGUSVVSZOP305	Ornithology and Entomology	02
VGVOE307	Science of Evolution	02

**Semester IV**

Course Code	Paper Title	Credit
VGUSMZ0401	Evolution and Scientific attitude	02
VGUSMZ0402	Cell Biology	02
VGUSMNZO403	Embryology, Reproduction and Pollution	02
VGUSVVSZOP405	Human Pathology	02
VGVOE407	Anthrozoology	02



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**1. Syllabus as per Choice Based Credit System**

- i) Name of the Programme : S.Y.B.Sc. Zoology
- ii) Course Code : **Semester- III - VGVUSMZ03**  
**Semester- IV - VGVUSMZ03**
- iii) Course Title : Zoology
- iv) Semester-wise Course Contents : Copy of the Syllabus enclosed
- v) References and Additional References : Enclosed in the Syllabus
- vi) Credit Structure
- No. of Credits per Semester : 22
- vii) No. of lectures per Unit : 10
- viii) No. of lectures per week : 08
- ix) No. of Tutorial per week : --
- x) No. of practical per week : 06 (per batch)
1. Scheme of Examination : **Internal Assessment (40 marks)**  
Class Test: 15 marks,  
Assignment: 15 marks  
Class Participation: 10 marks  
**External Assessment (60 marks)**  
**Semester End Exam:** Subjective  
07 Marks - One question out of two and  
08 Marks – two questions out of three  
from each unit for 3 units. (15 Marks each unit)  
15 Marks – 3 questions from each unit  
all questions are compulsory.
2. Special notes, if any : No
3. Eligibility, if any : As laid down in the College  
Admission brochure/ website
4. Fee Structure : As per College Fee Structure specifications
5. Special Ordinances / Resolutions, if any : No



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**Programme:** S.Y.B.Sc.

**Semester:** III

**Course:** Zoology- I (Major)

**Course code:** VGVUSMZ0301

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Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
6	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

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**Prerequisite**    1. Basic knowledge about Zoology  
                         2. Curiosity regarding aspects of the animal kingdom

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### Course Objectives

1. To develop the learner's understanding about the genetic basis of life.
2. To study Mendelian principles of inheritance and other patterns inheritance
3. To help learners learn about variations in traits and how they are passed on.



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**SEMESTER III**

<b>Course Content</b>			
<b>Unit No.</b>	<b>Module No.</b>	<b>Content</b>	<b>Lectures</b>
<b>VGVUSMZ0301 - Introduction to Molecular Genetics</b>			
<b>1</b>	I, II, III, IV	<p><b>Fundamentals of Genetics</b></p> <p><b>I. Introduction to genetics</b>            Definition, scope and importance of genetics, Classical and Modern concept of Gene (Cistron, muton, recon), Brief explanation of the following terms: Allele, wild type and mutant alleles, locus, dominant and recessive traits, homozygous and heterozygous, genotype and phenotype, genome.</p> <p><b>II. Mendelian Genetics</b>            Mendelian Genetics: Monohybrid cross, Dihybrid cross, test cross, back cross, Mendel's laws of Inheritance, Mendelian traits in man, Exceptions to Mendelian Inheritance: Incomplete dominance, Co-dominance, Lethal alleles, Epistasis Recessive, Double recessive, dominant and double dominant, Chromosome theory of inheritance, Pedigree analysis - Autosomal dominant and autosomal recessive, X- linked dominant, and X-linked recessive.</p> <p><b>III. Multiple Alleles and Multiple Genes</b>            Concept of multiple alleles, Coat colour in rabbit, ABO and Rh blood group systems, Polygenic inheritance with reference to skin colour and eye colour in man, Concept of Pleiotropy</p> <p><b>IV. Linkage and Crossing over</b>            Linkage and crossing over, Types of crossing over, Cytological basis of crossing over</p>	<b>10</b>
<b>2</b>	I, II, III	<p><b>Chromosomes and Heredity</b></p> <p><b>I. Chromosomes</b>            Types of chromosomes–Autosomes and Sex chromosomes, Chromosome structure - Heterochromatin, Euchromatin, Classification based on the position of centromere, Endomitosis, Giant chromosomes - Polytene and Lamp brush chromosomes and significance of Balbiani rings.</p> <p><b>II. Sex- determination</b>            Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZW, Sex determination in honey bees - Haplodiploidy, Sex determination in <i>Drosophila</i>-Genic balance theory, intersex,</p>	<b>10</b>



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		<p>gynandromorphs, Parthenogenesis, Hormonal influence on sex determination - Freemartin and sex reversal, Role of environmental factors - <i>Bonellia</i> and Crocodile, Barr bodies and Lyon hypothesis</p> <p><b>III. Sex linked, sex influenced and sex-limited inheritance.</b>  X-Linked: Colourblindness, Haemophilia,  Y-linked: Hypertrichosis, Sex-influenced genes, Sex limited genes</p>	
<b>3</b>	I, II, III	<p><b>Nucleic Acids</b></p> <p><b>I. Genetic material</b>  Griffith's transformation experiments, Avery-Macleod and McCarty, Hershey Chase experiment of Bacteriophage infection, Chemical composition and structure of nucleic acids, Double helix nature of DNA, Solenoid model of DNA, Types of DNA – A, B, Z forms, DNA in Prokaryotes -chromosomal and plasmid, Extra nuclear DNA -mitochondria and chloroplast, RNA as a genetic material in viruses, Types of RNA: Structure and function.</p> <p><b>II. Flow of genetic information in an Eukaryotic cell</b>  Central Dogma, DNA Replication in eukaryotic cells, Introduction to transcription and translation.</p> <p><b>III. Gene Expressions and regulation</b>  Concept of operon, Lac operon.</p>	<b>10</b>
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**



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**Practical based on Paper I**  
**VGUSMZOP301 (SEMESTER III)**

<b>List of experiments</b>	
<b>Sr. No.</b>	<b>Description</b>
1	Extraction and detection of DNA
2	Extraction and detection of RNA.
3	Study of polytene chromosomes.
4	Problems in Genetics a) Monohybrid/ Dihybrid cross b) X-linked inheritance c) Multiple alleles
5	Problems on molecular biology
6	Study of pedigree chart

<b>Semester III – VGVUSMZO301 - Introduction to Molecular Genetics (Major)</b> <b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks



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**Semester III – VGVUSMZ0301 - Introduction to Molecular Genetics (Major)**  
**(Internal Class Test Paper Pattern)**

<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks





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<b>Semester III – VGVUSMZ0301 - Introduction to Molecular Genetics (Major)</b> <b>(Theory Paper Pattern)</b>	
<b>Duration: 2 hrs</b>	<b>Marks: 60</b>
Q.1.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.1.B. Attempt any two a) b) c)	04M 04M 04M
Q.2.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.2.B. Attempt any two a) b) c)	04M 04M 04M
Q.3.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.3.B. Attempt any two a) b) c)	04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)	05M 05M 05M

<b>Semester III – VGVUSMZOP301 - Introduction to Molecular Genetics (Major)</b> <b>(Practical Paper Pattern)</b>	
<b>Duration: 5 hrs</b>	<b>Marks: 50</b>
<b>Major Question</b> Q1. Extraction and detection of DNA <b>OR</b> Q1. Extraction and detection of RNA	15 Marks
<b>Minor Question</b> Q2. Problems based on - a) Genetics – 1 problem b) Molecular biology – 1 problem	10 Marks
Q3. Identification	10 Marks



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a. Chromosome morphology b. Pedigree analysis	
Q4. Viva based on theory	05 Marks
Q5. Certified journal	10 Marks

### Course Outcome

After the completion of the course, students will able to

CO1 understand and apply the principles of inheritance, multiple alleles and crossing over

CO2 understand the structure and types of chromosomes.

CO3 correlate the disorders linked to a particular sex chromosome.

### Recommended resources

1. Principles of Genetics. Gardner, E.J., Simmons, M.J and Snustad, D.P. John Wiley and Sons
2. Concepts of Genetics. Klug, W.S., Cummings M.R., Spencer, C.A. Benjamin Cummings
3. Genetics- A Molecular Approach. Russell, P. J Benjamin Cummings
4. Genetics: Analysis of Genes and Genomes. Daniel L., Hartl, Elizabeth W. Jones Jones & Bartlett Publishers
5. Cell Biology Genetics, Molecular Biology Evolution and Ecology Verma P.S. and Agrawal P.K.,9th edition, S. Chand Publication, New Delhi
6. Principles of Genetics – Eight edition- Eldon John Gardner, Michael J. Simmons, D. Peter Snustad
7. Genetics- Weaver, Hedrick, third edition, McGraw Hill Education
8. Genetics A Mendelian approach Peter J.Russel, Pearson Benjamin Cummings
9. Genetics A conceptual approach, Benjamin A. Pierce, Southwestern University, W.H. Freeman and company, New York
10. Genetics, Third Edition, Monroe W. Strickberger



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**Programme:** S.Y.B.Sc.

**Semester:** III

**Course:** Zoology- II(Major)

**Course code:** VGVUSMZO302

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Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
6	-	2	2	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) - 2Hrs.										

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**Prerequisite**    1. Basic knowledge about Zoology  
                         2. Curiosity regarding aspects of the animal kingdom

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### Course Objectives

1. To introduce the concepts of physiology of nutrition, excretion and osmoregulation.
2. To expose the learners to various nutritional apparatus, excretory and osmoregulatory structures in different classes of organisms.
3. To expose the learners to various respiratory, circulatory, locomotory and reproductive structures in different classes of organisms.



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**SEMESTER III**

**Course Content**

Unit No.	Module No.	Content	Lectures
<b>VGVSUMZO302 - Fundamentals of Life Processes</b>			
<b>1</b>	I, II, III, IV, V	<p><b>Study of Nutrition and Excretion</b></p> <p><b>I. Comparative study of Nutritional Apparatus (structure and function):</b>  <i>Amoeba, Hydra</i>, Earthworm, Cockroach, Bivalve, Amphioxus, Pigeon, Ruminants</p> <p><b>II. Physiology of Digestion in Man</b></p> <p><b>III. Comparative study of Excretory and Osmoregulatory structures and function</b></p> <p style="margin-left: 20px;">a. Amoeba - contractile vacuoles  b. Planaria - Flame cells  c. Earthworm - Nephridia  d. Cockroach - Malpighian tubules and green gland  e. Bivalve - Organ of Bojanus</p> <p><b>IV. Categorization of animals based on principal nitrogenous excretory Products</b></p> <p><b>V. Structure of kidney, Uriniferous tubule and physiology of urine formation in man.</b></p>	<b>10</b>
<b>2</b>	I, II, III, IV, V, VI, VII	<p><b>Study of Respiration and Circulation</b></p> <p><b>I. Comparative study of Respiratory organs (structure and function)</b>  Earthworm, Spider, Rohu, Frog and Pigeon.</p> <p><b>II. Accessory respiratory structures:</b>  Anabas /Clarias</p> <p><b>III. Structure of lungs and physiology of respiration in man</b></p> <p><b>IV. Comparative study of circulation: Open and closed-  Single and Double</b></p> <p><b>V. Types of circulating fluids-</b>  Water, coelomic fluid, hemolymph, lymph and blood.</p> <p><b>VI. Comparative study of Hearts (Structure and function)</b>  Earthworm, Cockroach, Shark, Frog, Crocodile and Pigeon</p> <p><b>VII. Structure and mechanism of working of heart in man</b></p>	<b>10</b>



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<b>3</b>	I, II, III, IV	<p><b>Control and coordination, Locomotion and Reproduction</b></p> <p><b>I. Control and coordination</b>  Irritability – <i>Paramecium</i>, Nerve net in <i>Hydra</i>, Nerve ring and nerve cord in earthworm, Types of neurons on the basis of structure and function, Conduction of nerve impulse: Resting potential, action potential and refractory period, Synaptic transmission, Endocrine regulation: Hormones as chemical messengers, positive and negative feedback mechanisms</p> <p><b>II. Movement and Locomotion</b>  Locomotory organs - structure and function - a. Pseudopodia in <i>Amoeba</i> (sol gel theory), Cilia in <i>Paramecium</i>, b. Wings and legs in Cockroach, c. Tube feet in Starfish, d. Fins of fish</p> <p><b>III. Structure of Striated muscle fibre in human and Sliding filament theory</b></p> <p><b>IV. Reproduction</b>  Asexual Reproduction- Fission, fragmentation, gemmule formation, budding, Sexual reproduction - Gametogenesis, Structure of male and female gametes in human, Types of fertilization, Oviparity, viviparity, ovo-viviparity</p>	<b>10</b>
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**

**Practical based on Paper II**  
**VGUSMZOP302 (SEMESTER III)**

**List of experiments**

Sr. No.	Description
1	Urine analysis—Normal and abnormal constituents
2	Detection of ammonia in water excreted by fish
3	Detection of uric acid from excreta of Birds
4	Study of hearts (Cockroach, Shark, Frog, <i>Calotes</i> , Crocodile, Mammal)
5	Study of permanent slides based on the topic of reproduction a. Sponge gemmules b. Hydra budding c. T.S. of mammalian testis d. T.S. of mammalian ovary



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**Semester III – VGVUSMZO302 – Fundamentals of Life Processes (Major)**  
**(Internal Assessment Pattern)**

<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks

**Semester III – VGVUSMZO302 – Fundamentals of Life Processes (Major)**  
**(Internal Class Test Paper Pattern)**

<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks



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<b>Semester III – VGVUSMZ0302 – Fundamentals of Life Processes (Major)</b> <b>(Theory Paper Pattern)</b>	
<b>Duration: 2 hrs</b>	<b>Marks: 60</b>
Q.1.A. Attempt any one A)  A)	07M  07M
<b>OR</b>	
Q.1.B. Attempt any two a) b) c)	04M 04M 04M
Q.2.A. Attempt any one A)  A)	07M  07M
<b>OR</b>	
Q.2.B. Attempt any two a) b) c)	04M 04M 04M
Q.3.A. Attempt any one A)  A)	07M  07M
<b>OR</b>	
Q.3.B. Attempt any two a) b) c)	04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)	05M 05M 05M



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<b>Semester III – VGVUSMZOP302 – Fundamentals of Life Processes (Major)</b> <b>(Practical Paper Pattern)</b>	
<b>Duration: 5 hrs</b>	<b>Marks: 50</b>
<b>Major Question</b> Q1. Urine analysis - Normal and abnormal constituents	15 Marks
<b>Minor Question</b> Q2. Detection of ammonia in water excreted by fish <b>OR</b> Q2. Detection of uric acid from excreta of Birds	08 Marks
Q3. Identification a. Study of hearts b. Study of hearts c. Permanent slides on reproduction d. Permanent slides on reproduction	12 Marks
Q4.Viva	05 Marks
Q5. Journal	10 Marks

<b>Course Outcome</b>
After the completion of the course, students will able to
CO1 understand the increasing complexity of nutritional, excretory and osmoregulatory physiology in evolutionary hierarchy.
CO2 correlate the habit and habitat with nutritional, excretory and osmoregulatory structures
CO3 correlate the habit and habitat with respiratory and circulatory structures.
CO4 understand the process of control and coordination by nervous and endocrine regulation.
CO5 be acquainted with various reproductive strategies present in animals.

<b>Recommended resources</b>
1. Vertebrate Zoology Volume I- Jordan and Verma, S. Chand and Co.
2. Invertebrate Zoology Volume II- Jordan and Verma, S. Chand and Co.
3. Invertebrate Zoology- Majupuria T. C., Nagin S.and Co.
4. Chordate Zoology- Dhama P. S. and Dhama J. K., R. Chand and Co.
5. Invertebrate Zoology- Dhama P. S. and Dhama J. K., R. Chand and Co.
6. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition.
7. Zoology- Miller S. A. and Harley J. B., Tata McGraw Hill.
8. Modern Textbook of Zoology, Invertebrates, Kotpal R. L
9. Biological Science, Taylor D.J., Stout G.W., Green N.P.O, Soper R.Cambridge University Press.





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**Programme:** S.Y.B.Sc.

**Semester:** III

**Course:** Zoology- III (For Major)

**Course code:** VGVUSMZO303

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
6	-	2	2	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) - 2Hrs.										

**Prerequisite** 1. Basic knowledge about Zoology

2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. To equip learners with a sound knowledge of how animals interact with one another and their environment.
2. To enable the learners to understand different behavioural patterns
3. To acquaint learners with the concepts of parasitism, their relationship with environment.
4. To disseminate information on economic aspects of zoology like apiculture, vermiculture, dairy science.
5. To encourage young learners for self-employment and career development.



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**SEMESTER III**

**Course Content**

Unit No.	Module No.	Content	Lectures
<b>VGVSUMZO303 - Applied Zoology</b>			
1	I, II, III	<p><b>Ethology</b></p> <p><b>I. Introduction to Ethology</b>            Definition, History and Scope of Ethology, Animal behaviour - Innate and Learned behaviour, Types of learning- Habituation, Imprinting and types of imprinting -filial and sexual, Classical conditioning, Instrumental learning and insight learning.</p> <p><b>II. Aspects of animal behaviour</b>            Communication in Bees and Ants, Mimicry and colouration, Role of hormones and pheromones in sexual behaviour, Displacement activities, Ritualization, Migration in fish, schooling behaviour, Habitat selection, territorial behaviour, food selection and foraging, behaviour in African ungulates</p> <p><b>III. Social behaviour</b>            Social behaviour in primates-Hanuman langur, Elements of Socio-biology: Selfishness, animal interactions, altruism, kinship and inclusive fitness</p>	10
2	I, II, III, IV, V	<p><b>Parasitology</b></p> <p><b>I. Introduction to Parasitology and types of parasites</b>            Definitions: parasitism, host, parasite, vector-biological and mechanical, Types of parasites- Ectoparasites, Endoparasite and their subtypes, Parasitic adaptations in Ectoparasites and Endoparasites, Types of hosts: intermediate and definitive, reservoir</p> <p><b>II. Host-parasite relationship-Host specificity</b>            Definition, structural specificity, physiological specificity and ecological specificity.</p> <p><b>III. Life cycle, pathogenicity, control measures and treatment</b>  <i>Entamoeba histolytica</i>, <i>Fasciola hepatica</i>, <i>Taenia solium</i>, <i>Wuchereria bancrofti</i></p> <p><b>IV. Morphology, life cycle, pathogenicity, control measures and treatment</b>            Head louse (<i>Pediculus humanus capitis</i>), Mite (<i>Sarcoptes scabiei</i>), Bed bug (<i>Cimex lectularis</i>)</p> <p><b>V. Parasitological significance</b>            Zoonosis- Bird flu, Anthrax, Rabies and Toxoplasmosis</p>	10



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3	I, II, III	<p><b>Economic Zoology</b></p> <p><b>I. Apiculture</b>  Methods of bee keeping and management-  An introduction to different species of honey bees used in apiculture, Selection of flora and bees for apiculture, Advantages and disadvantages of traditional and modern methods of apiculture, Pests and Bee enemies - Wax moth, wasp, black ants, bee- eaters , king crow and disease control. Economic importance - Honey- Production, Chemical composition and economic importance, Bees wax- Economic importance, Role of honey bees in pollination.</p> <p><b>II. Vermiculture</b>  Rearing methods, management and economic importance - An introduction to different species of earthworms used in vermiculture, Methods of vermiculture, Maintenance and harvesting, Economic importance: advantages of vermiculture, demands for worms; market for vermin-compost and entrepreneurship.</p> <p><b>III. Dairy Science</b>  Dairy development in India - Role of dairy development in rural economy, employment opportunities, Dairy Processing, Filtration, cooling, chilling, clarification, pasteurization, freezing, Milk and milk products, Composition of milk, Types of milk: a) Buffalo milk and b) Cow milk (a1 and a2) whole milk and toned milk, Milk products</p> <p><b>IV. Lac culture</b>  Introduction, Lac Insect Taxonomy, Distribution, Lifecycle, Host plants.</p>	
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**



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**Practical based on Paper III**  
**VGUSMZOP304 (SEMESTER III)**

List of experiments	
Sr. No.	Description
1	Extraction of Casein from Milk and its qualitative estimation
2	Preparation of paneer from given milk sample
3	Preparation of beeswax
4	Study of ethological aspects: a. Warning Colouration b. Instincts c. Imprinting d. Communication in animals: Chemical signals and sound signals e. Displacement activities in animals: Courtship and mating behavior in animals and ritualization
5	Study of Protozoan parasites: a. <i>Trypanosoma gambiense</i> b. <i>Giardia intestinalis</i> Study of Helminth parasites: c. <i>Ancylostoma duodenale</i> d. <i>Dracunculus medinensis</i> Study of Ectoparasites: e. Leech f. Tick g. Mite

Semester III – VGUSMZO303 – Applied Zoology (Major)	
(Internal Assessment Pattern)	
Duration:	Marks: 40
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks



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<b>Semester III – VGVUSMZO303 – Applied Zoology (Major)</b>	
<b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks

<b>Semester III – VGVUSMZO303 – Applied Zoology (Major)</b>	
<b>(Theory Paper Pattern)</b>	
<b>Duration: 2 hrs</b>	<b>Marks: 60</b>
Q.1.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.1.B. Attempt any two a) b) c)	04M 04M 04M
Q.2.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.2.B. Attempt any two a) b) c)	04M 04M 04M



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Q.3.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.3.B. Attempt any two a) b) c)		04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)		05M 05M 05M

<b>Semester III - VGVUSMZOP304 – Applied Zoology (Major)</b>		<b>(Practical Paper Pattern)</b>
<b>Duration: 5 hrs</b>		<b>Marks: 50</b>
<b>Major Question</b> Q1. Extraction of Casein from Milk and its qualitative estimation <b>OR</b> Q1. Preparation of paneer from the given milk sample.		12 Marks
<b>Minor Question</b> Q2. Report on preparation of beeswax		08 Marks
Q3. Identify and describe as per instructions: a. Ethology b. Ethology c. Protozoan parasites d. Helminth parasites e. Ectoparasites		15 Marks
Q5. Viva based on theory		05 Marks
Q.6. Certified Journal		10 Marks

<b>Course Outcome</b>
After the completion of the course, students will able to
CO1 understand different types of animal behaviour and their role in biological adaptations.
CO2 understand the general epidemiological aspects of parasites that affect humans and apply simple preventive measures for the same.
CO3 know the use of animals to mankind and the means to make the most of it.
CO4 pursue entrepreneurship as career
CO5 learn the modern techniques in animal husbandry.



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**Recommended resources**

1. Animal Behaviour- David Mc Farland
2. Animal Behaviour- Mohan Arora
3. Animal Behaviour- Reena Mathur
4. An introduction to Animal Behaviour- Dawkins
5. Animal Behaviour-Agarwal
6. Animal Behaviour- Tinbergen
7. Biology of Insects- 1992 Saxena S. C. Oxford and IBH Publishing Co New Delhi. Bombay. Calcutta
8. A Text Book of Entomology- 1974 Mathur V. K. and Upadhyay K Goel Printing press, Barani.
9. Bee and Bee Keeping- Roger A. Morse, Cornell University Press London
10. Vermiculture Technology - Clive A. Edwards, Norman Q. Arancon and Rhonda Sherman
11. Parasitology- Chatterjee K.D., Chatterjee Medical Publishers.
12. Medical Parasitology- Arora
13. Textbook of Medical Parasitology-.C.K Jayaram Paniker, Jaypee Brothers.
14. A text book of Parasitology- Kochhar S.K. Dominant Pub. & Dis, New Delhi.
15. Essentials of Parasitology- Gerald and Schmidt: Universal Bookstall, New Delhi.
16. Parasitology- Sharma P.N. and RatnuL.N., Chand S &Co. Pvt. Ltd.
17. Introduction to Parasitology- Chandler and Read John Wiley & Sons
18. Economic Zoology- Biostatistics and Animal behaviour – S. Mathur, Rastogi Publications.
19. Economic Zoology- Shukla G.S. & Upadhyay V.B., Rastogi Publications.
20. A handbook on Economic Zoology, S.Chand & Co.



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**Programme:** S.Y.B.Sc.

**Semester:** III

**Course:** Zoology- III (For Minor)

**Course code:** VGVUSNZO303

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
2	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

**Prerequisite** 1. Basic knowledge about Zoology

2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. To equip learners with a sound knowledge of how animals interact with one another and their environment.
2. To enable the learners to understand different behavioural patterns
3. To acquaint learners with the concepts of parasitism, their relationship with environment.
4. To disseminate information on economic aspects of zoology like apiculture, vermiculture, dairy science.
5. To encourage young learners for self-employment and career development.





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**SEMESTER III**

**Course Content**

Unit No.	Module No.	Content	Lectures
<b>VGVSUNZO303 - Applied Zoology</b>			
1	I, II, III	<p><b>Ethology</b></p> <p><b>I. Introduction to Ethology</b>            Definition, History and Scope of Ethology, Animal behaviour - Innate and Learned behaviour, Types of learning- Habituation, Imprinting and types of imprinting -filial and sexual, Classical conditioning, Instrumental learning and insight learning.</p> <p><b>II. Aspects of animal behaviour</b>            Communication in Bees and Ants, Mimicry and colouration, Role of hormones and pheromones in sexual behaviour, Displacement activities, Ritualization, Migration in fish, schooling behaviour, Habitat selection, territorial behaviour, food selection and foraging, behaviour in African ungulates</p> <p><b>III. Social behaviour</b>            Social behaviour in primates-Hanuman langur, Elements of Socio-biology: Selfishness, cooperation, altruism, kinship and inclusive fitness</p>	10
2	I, II, III, IV, V	<p><b>Parasitology</b></p> <p><b>I. Introduction to Parasitology and types of parasites</b>            Definitions: parasitism, host, parasite, vector-biological and mechanical, Types of parasites- Ectoparasites, Endoparasite and their subtypes, Parasitic adaptations in Ectoparasites and Endoparasites, Types of hosts: intermediate and definitive, reservoir</p> <p><b>II. Host-parasite relationship-Host specificity</b>            Definition, structural specificity, physiological specificity and ecological specificity.</p> <p><b>III. Life cycle, pathogenicity, control measures and treatment</b>  <i>Entamoeba histolytica</i>, <i>Fasciola hepatica</i>, <i>Taenia solium</i>, <i>Wuchereria bancrofti</i></p> <p><b>IV. Morphology, life cycle, pathogenicity, control measures and treatment</b>            Head louse (<i>Pediculus humanus capitis</i>), Mite (<i>Sarcoptes scabiei</i>), Bed bug (<i>Cimex lectularis</i>)</p> <p><b>V. Parasitological significance</b>            Zoonosis- Bird flu, Anthrax, Rabies and Toxoplasmosis</p>	10



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<b>3</b>	I, II, III	<p><b>Economic Zoology</b></p> <p><b>I. Apiculture</b>  Methods of bee keeping and management-  An introduction to different species of honey bees used in apiculture, Selection of flora and bees for apiculture, Advantages and disadvantages of traditional and modern methods of apiculture, Pests and Bee enemies - Wax moth, wasp, black ants, bee- eaters , king crow and disease control. Economic importance - Honey- Production, Chemical composition and economic importance, Bees wax- Economic importance, Role of honey bees in pollination.</p> <p><b>II. Vermiculture</b>  Rearing methods, management and economic importance - An introduction to different species of earthworms used in vermiculture, Methods of vermiculture, Maintenance and harvesting, Economic importance: advantages of vermiculture, demands for worms; market for vermin-compost and entrepreneurship.</p> <p><b>III. Dairy Science</b>  Dairy development in India - Role of dairy development in rural economy, employment opportunities, Dairy Processing, Filtration, cooling, chilling, clarification, pasteurization, freezing, Milk and milk products, Composition of milk, Types of milk: a) Buffalo milk and b) Cow milk (a1 and a2) whole milk and toned milk, Milk products</p> <p><b>IV. Lac culture</b>  Introduction, Lac Insect Taxonomy, Distribution, Lifecycle, Host plants.</p>	<b>10</b>
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**



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**Practical based on Paper III**  
**VGUSNZOP304 (SEMESTER III)**

<b>List of experiments</b>	
<b>Sr. No.</b>	<b>Description</b>
<b>1</b>	Extraction of Casein from Milk and its qualitative estimation
<b>2</b>	Preparation of paneer from given milk sample
<b>3</b>	Preparation of beeswax
<b>4</b>	Study of ethological aspects: a. Warning Colouration b. Instincts c. Imprinting d. Communication in animals: Chemical signals and sound signals e. Displacement activities in animals: Courtship and mating behavior in animals and ritualization
<b>5</b>	Study of Protozoan parasites: a. <i>Trypanosoma gambiense</i> b. <i>Giardia intestinalis</i> Study of Helminth parasites: c. <i>Ancylostoma duodenale</i> d. <i>Dracunculus medinensis</i> Study of Ectoparasites: e. Leech f. Tick g. Mite
	<b>Only for Minor students</b>
<b>6</b>	Study of Honey Bee : a. Life Cycle of Honey Bee and Bee Hive b. Mounting of Mouthparts of Honey Bee c. Mounting of Legs of Honey Bee d. Mounting of Sting Apparatus of Honey Bee
<b>7</b>	Extraction of lactose from milk and its qualitative estimation.
<b>8</b>	Measurement of density of milk using different samples by Lactometer
<b>9</b>	Morphology of earthworm
<b>10</b>	Project- Suggested topics on economic zoology (e.g. Apiculture, sericulture/ lac culture / vermicompost Technique / Construction of artificial beehives/Animal husbandry/ aquaculture, etc.)



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<b>Semester III – VGVUSNZO303 – Applied Zoology (Minor)</b> <b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks

<b>Semester III – VGVUSNZO303 – Applied Zoology (Minor)</b> <b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks



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<b>Semester III – VGVUSNZO303 – Applied Zoology (Minor)</b>		<b>(Theory Paper Pattern)</b>
<b>Duration: 2 hrs</b>		<b>Marks: 60</b>
Q.1.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.1.B. Attempt any two a) b) c)		04M 04M 04M
Q.2.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.2.B. Attempt any two a) b) c)		04M 04M 04M
Q.3.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.3.B. Attempt any two a) b) c)		04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)		05M 05M 05M



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<b>Semester III – VGVUSNZOP304 – Applied Zoology (Minor)</b>	
<b>(Practical Paper Pattern)</b>	
<b>Duration: 5 hrs</b>	<b>Marks: 50</b>
<p><b>Major Question</b></p> <p>Q1. Extraction of Casein from Milk and its qualitative estimation  <b>OR</b>            Q1. Preparation of paneer from the given milk sample  <b>OR</b>            Q1. Measurement of density of milk using different samples by lactometer  <b>OR</b>            Q1. Extraction of lactose from milk and its qualitative estimation</p>	12 Marks
<p><b>Minor Question</b></p> <p>Q2. Life Cycle of Honey Bee and Bee Hive  <b>OR</b>            Q2. Mounting of Mouthparts of Honey Bee  <b>OR</b>            Q2. Mounting of Legs of Honey Bee  <b>OR</b>            Q2. Mounting of Sting Apparatus of Honey Bee  <b>OR</b>            Q2. Morphology of Earthworm</p>	05 Marks
<p>Q3. Identify and describe as per instructions:</p> <ol style="list-style-type: none"> <li>a. Ethology</li> <li>b. Ethology</li> <li>c. Protozoan parasites</li> <li>d. Helminth parasites</li> <li>e. Ectoparasites</li> </ol>	10 Marks
Q4. Report on preparation of beeswax	08 Marks
Q5. Viva based on theory	05 Marks
Q6. Certified Journal	10 Marks



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**Course Outcome**

After the completion of the course, students will able to

CO1 understand different types of animal behaviour and their role in biological adaptations.

CO2 understand the general epidemiological aspects of parasites that affect humans and apply simple preventive measures for the same.

CO3 know the use of animals to mankind and the means to make the most of it.

CO4 pursue entrepreneurship as career

CO5 learn the modern techniques in animal husbandry.

**Recommended resources**

1. Animal Behaviour- David Mc Farland
2. Animal Behaviour- Mohan Arora
3. Animal Behaviour- Reena Mathur
4. An introduction to Animal Behaviour- Dawkins
5. Animal Behaviour-Agarwal
6. Animal Behaviour- Tinbergen
7. Biology of Insects- 1992 Saxena S. C. Oxford and IBH Publishing Co New Delhi. Bombay. Calcutta
8. A Text Book of Entomology- 1974Mathur V. K. and Upadhyay K Goel Printing press, Barani.
9. Bee and Bee Keeping- Roger A. Morse, Conell University Press London
10. Vermiculture Technology - Clive A. Edwards, Norman Q. Arancon and Rhonda Sherman
11. Parasitology- Chatterjee K.D., Chatterjee Medical Publishers.
12. Medical Parasitology- Arora
13. Textbook of Medical Parasitology-.C.K Jayaram Paniker, Jaypee Brothers.
14. A text book of Parasitology- Kochhar S.K. Dominant Pub. & Dis, New Delhi.
15. Essentials of Parasitology- Gerald and Schmidt: Universal Bookstall, New Delhi.
16. Parasitology- Sharma P.N. and RatnuL.N., Chand S &Co. Pvt. Ltd.
17. Introduction to Parasitology- Chandler and Read John Wiley & Sons
18. Economic Zoology- Biostatistics and Animal behaviour – S. Mathur, Rastogi Publications.
19. Economic Zoology- Shukla G.S. & Upadhyay V.B., Rastogi Publications.
20. A handbook on Economic Zoology, S.Chand & Co.



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**Programme:** S.Y.B.Sc.

**Semester:** III

**Course:** Ornithology and Entomology (VSC)

**Course code:** VGVUSVSZOP305

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Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

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**Prerequisite**

1. Basic knowledge about Zoology
2. Curiosity regarding aspects of the animal kingdom

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### Course Objectives

1. To enable learners to gain practical skill of recognizing birds in the field, crucial for careers in wildlife management and ecological research.
2. To gain knowledge about rearing of silkworm, mulberry cultivation, disease and pest management, and proper harvesting techniques.
3. To enable learners to establish and manage an apiary for honeybee production, including hive selection, colony management techniques, honey extraction methods, and disease mitigation strategies.





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**Practical based on VSC**  
**VGUSVSZOP305 (SEMESTER III)**

<b>List of experiments</b>	
<b>Sr. No.</b>	<b>Description</b>
<b>1</b>	Morphology of birds
<b>2</b>	Morphology of a. cockroach b. honeybee
<b>3</b>	Method of collection and preservation of insects
<b>4</b>	Study of migration in birds
<b>5</b>	Identification of birds - a. Coppersmith Barbet b. Red vented Bulbul c. Rose ringed Parakeet d. Magpie Robin e. Jungle Babbler f. Black Drongo g. Ducks h. Swans i. Grebes j. Storks k. Penguin
<b>6</b>	Study of apiculture
<b>7</b>	Study of sericulture
<b>8</b>	Avian taxidermy
<b>9</b>	Visit to the museum/ bird sanctuary and report on it
<b>10</b>	Visit to an apiculture / sericulture centre and report on it



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<b>Semester II- VGVUSVSZOP305 - Ornithology and Entomology (VSC)</b> (Practical Paper Pattern)	
<b>Duration: 3 hrs</b>	<b>Marks: 50</b>
Q1. Morphology of cockroach <b>OR</b> Q1. Morphology of honeybee <b>OR</b> Q1. Morphology of birds	15 Marks
Q2. Identify and describe based on – a. Collection and preservation of insect b. Type of migration in birds c. Methods in avian taxidermy d. Identification of birds e. Identification of birds	15 Marks
Q4.. Report on the visit to museum/ bird sanctuary and viva based on it.	05 Marks
Q5. Report on visit to apiculture / sericulture centre and viva based on it	05 Marks
Q6. Certified Journal	10 Marks

### Course Outcome

After the completion of the course, students will able to

CO1 demonstrate a comprehensive understanding of avian anatomy, physiology, and adaptations for flight

CO2 apply ornithological field techniques to identify birds by sight and sound, and to conduct basic population surveys

CO3 apply beekeeping principles and practices to establish, manage, and maintain a healthy honeybee colony.

CO4 rear silkworms following proper techniques to optimize cocoon production

### Recommended resources

1. Invertebrate Zoology Volume II- Jordan and Verma, S. Chand and Co.
2. Invertebrate Zoology- Majupuria T. C., Nagin S.and Co.
3. Vertebrate Zoology Volume I- Jordan and Verma, S. Chand and Co.
4. Chordate Zoology- Dhami P. S. and Dhami J. K., R. Chand and Co.
5. Grimmett, R., Inskipp, C., & Inskipp, T. (2016). Birds of the Indian Subcontinent: India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives. Bloomsbury Publishing.



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**Programme:** S.Y.B.Sc.

**Semester:** III

**Course:** Zoology - Open Elective (for Arts)

**Course code:** VGVUOE307

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
2	-	-	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

**Prerequisite**    1. Basic knowledge about Zoology  
                         2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. Enables learners to understand how evolutionary theory can be used to understand different aspects of the human experience.
2. Learners will be able to understand the complexity of human behavior resulting from both biological and social factors.
3. Learners will gain a historical perspective on the evolution of evolutionary theory, tracing its development from early ideas to current understandings.



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**SEMESTER III**

<b>Course Content</b>			
<b>Unit No.</b>	<b>Module No.</b>	<b>Content</b>	<b>Lectures</b>
<b>VGVOUE307 - Science of Evolution</b>			
<b>1</b>	I, II, III	<b>Psychology and evolution</b> I. Introduction to psychology and evolution II. Amygdala - center of emotions, psychosomatic behavior, conscious mind, subconscious mind, III. Altruism, sexual selection, adaptiveness of human behavior, Nature vs Nurture.	<b>10</b>
<b>2</b>	I, II, III	<b>Sociology and evolution</b> I. Introduction to sociology and evolution II. Concepts of Darwinian evolution - natural selection, adaptation, Social Darwinism III. Broca's and Wernicke's Areas, Evolution of brain size and intelligence IV. Social knowledge in primates, Language and the Evolution of Communication Skills, The cultural evolution and ecology of institutions	<b>10</b>
<b>3</b>	I, II, III	<b>The history of evolution</b> I. Evolution of horses, the interaction of Horses and humans and how it shaped modern society, II. Evolution of Elephants, role of elephants in ancient and modern human society III. Evolution of Humans, The influence of evolutionary history on human health and disease	<b>10</b>
<b>Total No. of Lectures</b>			<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**



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<b>Semester III – VGVUOE307 – Science of Evolution (OE for Arts)</b> <b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks

<b>Semester III – VGVUOE307– Science of Evolution (OE for Arts)</b> <b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks



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<b>Semester III – VGVUOE307– Science of Evolution (OE for Arts)</b>		<b>(Theory Paper Pattern)</b>
<b>Duration: 2 hrs</b>		<b>Marks: 60</b>
Q.1.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.1.B. Attempt any two a) b) c)		04M 04M 04M
Q.2.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.2.B. Attempt any two a) b) c)		04M 04M 04M
Q.3.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.3.B. Attempt any two a) b) c)		04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)		05M 05M 05M

<b>Course Outcome</b>
After the completion of the course, students will able to
CO1 know the scientific reasoning behind how human emotions evolved
CO2 understand the role of evolution in shaping social structures
CO3 undertsand the history of how early animals evolved



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**Recommended resources**

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8126459/>
2. Wuketits, F. M., & Antweiler, C. (Eds.). (2008). Handbook of evolution: The evolution of human societies and cultures. John Wiley & Sons.
3. The Oxford handbook of evolutionary psychology. Edited by R.I.M. Dunbar and Louise Barrett.
4. Benton, M. L., Abraham, A., LaBella, A. L., Abbot, P., Rokas, A., & Capra, J. A. (2021). The influence of evolutionary history on human health and disease. Nature Reviews Genetics, 22(5), 269-283.



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**Programme:** S.Y.B.Sc.

**Semester:** IV

**Course:** Zoology- I (Major)

**Course code:** VGVUSMZ0401

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
6	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

**Prerequisite**    1. Basic knowledge about Zoology  
                         2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. To impart scientific knowledge about how life originated and evolved on our planet.
2. To develop knowledge and understanding of genetic variability within a population and how the change in the gene pool leads to evolution of species
3. To inculcate scientific temperament in the learner and research-oriented skills in students.





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**SEMESTER IV**

<b>Course Content</b>			
<b>Unit No.</b>	<b>Module No.</b>	<b>Content</b>	<b>Lectures</b>
<b>VGVUSMZO401 - Evolution and Scientific Attitude</b>			
<b>1</b>	I, II, III	<p><b>Origin and Evolution of Life</b></p> <p><b>I. Introduction</b> Origin of Universe, Chemical evolution - Miller-Urey experiment, Haldane and Oparin theory, Origin of Life, Origin of Eukaryotic cell</p> <p><b>II. Evidences in favour of Organic evolution</b> Evidences from: Geographical distribution, Palaeontology, Anatomy, Embryology, Physiology and Genetics</p> <p><b>III. Theories of organic evolution</b> Theory of Lamarck, Theory of Darwin and Neo Darwinism, Mutation Theory, Modern Synthetic theory, Weismann's Germplasm theory, Neutral theory of Molecular evolution</p>	<b>10</b>
<b>2</b>	I, II, III	<p><b>Population Genetics and Evolution</b></p> <p><b>I. Introduction to Population genetics</b> Definition, Brief explanation of the following terms: Population, Gene pool, Allele frequency, Genotype frequency, Phenotype frequency, Microevolution</p> <p><b>II. Population genetics</b> Hardy- Weinberg Law, Factors that disrupt Hardy Weinberg equilibrium: Mutation, Migration (Gene flow), Non-random mating, Genetic drift (Sampling error, Fixation, Bottleneck effect and Founder effect), Natural Selection, Patterns of Natural Selection, Stabilizing selection, Directional selection, Disruptive selection</p> <p><b>III. Evolutionary genetics</b> Genetic variation: Genetic basis of Variation-Mutations and Recombination (crossing over during meiosis, independent assortment of chromosomes during meiosis and random union of gametes during fertilization), Nature of genetic variations: Genetic polymorphism, Balanced polymorphism, Mechanisms that preserve balanced Polymorphism- Heterozygote advantage and frequency dependent selection, Neutral variations, Geographic variation (Cline), Species Concept: Biological species concept and evolutionary species concept, Speciation and Isolating mechanisms: Definition and Modes of speciation (Allopatric,</p>	<b>10</b>



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		Sympatric, Parapatric and Peripatric ), Geographical isolation, Reproductive isolation and its isolating mechanisms (Prezygotic and Postzygotic), Macroevolution and Megaevolution: Concept and Patterns of macroevolution (Stasis, Preadaptation /Exaptation, Mass extinctions, Adaptive radiation and Coevolution)	
<b>3</b>	I, II, III, IV, V	<p><b>Scientific Attitude Methodology, Scientific Writing and Ethics in Scientific Research</b></p> <p><b>I. Process of science:</b>  A dynamic approach to investigation- The Scientific method, Deductive reasoning and inductive reasoning, Critical thinking, Role of chance in scientific discovery, Scientific Research: Definition, Difference between method and methodology, Characteristics, Types, Steps in the Scientific Method: Identification of research problem, Formulation of research hypothesis, Testing the hypothesis using experiments or surveys, Preparing research/study design including methodology and execution (Appropriate controls, sample size, technically sound, free from bias, repeat experiments for consistency), Documentation of data, Data analysis and interpretation, Results and Conclusions, Dissemination of data: Reporting results to scientific community (Publication in peer- reviewed journals, thesis, dissertation, reports, oral presentation, poster presentation), Application of knowledge: Basic research, Applied research, Translational research, Patent</p> <p><b>II. Scientific writing:</b>  Structure and components of a research paper:(Preparation of manuscript for publication of research paper- Title, Authors and their affiliations, Abstract, Keywords and Abbreviations, Introduction, Material and Methods, Results, Discussion, Conclusions, Acknowledgement, Bibliography; Figures, Tables and their legends</p> <p><b>III. Writing a review paper</b>  Structure and components of research report: Report writing, Types of report, Computer application: Plotting of graphs, Statistical analysis of data. Internet and its application in Research-Literature survey, Online submission of manuscript for publication</p> <p><b>IV. Ethics</b>  Ethics in animal research: The ethical and sensitive care and use of animals in research, teaching and testing, Approval from Institutional animal ethics Committee, Ethics in clinical research: Approval from Clinical Research Ethics Committee Informed consent, Approval from concerned/ appropriate</p>	<b>10</b>



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		authorities: National Biodiversity Authority, State Biodiversity Board, Forest Department, Conflict of interest <b>V. Plagiarism</b>	
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**

**Practical based on Paper I**  
**VGUSMZOP401 (SEMESTER IV)**

**List of experiments**

Sr. No.	Description
<b>1</b>	Study of population density by Line transect method & Quadrant method and calculate different diversity indices. a. Index of Dominance b. Index of frequency c. Rarity Index d. Shannon Index e. Index of species diversity
<b>2</b>	Study of Prokaryotic cells (bacteria) by Crystal violet staining technique
<b>3</b>	Study of Eukaryotic cells (WBCs) from blood smear by Leishman's stain
<b>4</b>	Bibliography/ Abstract writing
<b>5</b>	Identification and study of fossils a. Arthropods: Trilobite b. Mollusca: Ammonite c. Aves: Archaeopteryx
<b>6</b>	Identification of a. Allopatric speciation (Cyprinodont species) b. Sympatric speciation (Hawthorn fly and Apple maggot fly) c. Parapatric speciation (Snail)



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<b>Semester IV – VGVUSMZ0401 – Evolution and Scientific Attitude (Major)</b> <b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks

<b>Semester IV – VGVUSMZ0401 – Evolution and Scientific Attitude (Major)</b> <b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks



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<b>Semester IV – VGVUSMZ0401 – Evolution and Scientific Attitude (Major)</b>	
<b>(Theory Paper Pattern)</b>	
<b>Duration: 2 hrs</b>	<b>Marks: 60</b>
Q.1.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.1.B. Attempt any two a) b) c)	04M 04M 04M
Q.2.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.2.B. Attempt any two a) b) c)	04M 04M 04M
Q.3.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.3.B. Attempt any two a) b) c)	04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)	05M 05M 05M





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**Programme:** S.Y.B.Sc.

**Semester:** IV

**Course:** Zoology- II(Major)

**Course code:** VGVUSMZO402

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
6	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

**Prerequisite**    1. Basic knowledge about Zoology  
                         2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. To study the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton.
2. To acquaint the learner with the ultrastructure of cell organelles and their functions
3. To give learner insight into the structure of biomolecules, and their role in sustenance of life



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**SEMESTER IV**

<b>Course Content</b>			
Unit No.	Module No.	Content	Lectures
<b>VGVSUMZO402 - Cell Biology</b>			
<b>1</b>	I, II, III, IV, V	<p><b>Cell Biology</b></p> <p><b>I. Introduction to cell biology</b>            Definition and scope, Cell theory, Generalized prokaryotic, eukaryotic cell: size, shape and structure</p> <p><b>II. Nucleus</b>            Size, shape, number and position, Structure and functions of interphase nucleus, Ultrastructure of nuclear membrane and pore complex, Nucleolus: general organization, chemical composition &amp; functions, Nuclear sap/ nuclear matrix, Nucleocytoplasmic interactions</p> <p><b>III. Plasma membrane</b></p> <ol style="list-style-type: none"> <li>a. Fluid Mosaic Model</li> <li>b. Junctional complexes</li> <li>c. Membrane receptors</li> <li>d. Modifications: Microvilli and Desmosomes</li> </ol> <p><b>IV. Transport across membrane</b></p> <ol style="list-style-type: none"> <li>a. Diffusion and Osmosis</li> <li>b. Transport: Passive and Active</li> <li>c. Endocytosis and Exocytosis</li> </ol> <p><b>V. Cytoskeletal structures Microtubules:</b>            Composition and functions, Microfilaments: Composition and Functions</p>	<b>10</b>
<b>2</b>	I, II, III, IV	<p><b>Endomembrane System</b></p> <p><b>I. Endoplasmic reticulum:</b>            General morphology of endomembrane system, Morphology and Types of ER, Biogenesis of ER, Functions of RER and SER</p> <p><b>II. Golgi complex:</b>            Morphology of Golgi complex, Cytochemistry, Functions of Golgi complex Protein Glycosylation, Lipid and Polysaccharide Metabolism, Protein Sorting and Secretion, Golgi anti-apoptotic protein (GAAP)</p> <p><b>III. Lysosomes:</b>            Origin, occurrence and polymorphism, Functions of lysosomes: Peroxisomes: Origin, morphology &amp; functions</p> <p><b>IV. Mitochondria:</b>            Morphology and chemical composition of mitochondria, Bioenergetics, Chemical energy &amp; ATP Glycolysis Krebs cycle, Respiratory chain and Oxidative phosphorylation</p>	<b>10</b>





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<b>3</b>	I, II, III, IV, V	<p><b>Biomolecules</b></p> <p><b>I. Biomolecules :</b> Concept of Micromolecules and Macromolecules</p> <p><b>II. Carbohydrates:</b> Definition Classification, Properties and Isomerism, Glycosidic bond Structure of – a. Monosaccharides- Glucose and Fructose, b. Oligo-saccharides - Lactose and Sucrose, c. Polysaccharides Cellulose, Starch, Glycogen and Chitin Biological role and their Clinical significance</p> <p><b>III. Amino Acids and Proteins:</b> Basic structure of amino acid, classification of amino acids, Essential and Non-essential amino acids, Peptide bond, Protein conformation: Primary, Secondary, Tertiary, Quaternary Types of proteins – Structural (Collagen) and functional proteins (Hemoglobin) role and their Clinical significance</p> <p><b>IV. Lipids:</b> Definition, classification of lipids with examples, Ester linkage Physical and Chemical properties of lipids, Saturated and Unsaturated fatty acids , Essential fatty acids Triacylglycerols, Phospholipids (Lecithin and Cephalin) and Steroids (Cholesterol), Biological role and their Clinical significance</p> <p><b>V. Vitamins:</b> Water soluble vitamins(e.g. Vit C, Vit B12), Lipid soluble, vitamins (e.g. Vit A, Vit D), Biological role and their Clinical significance</p>	<b>10</b>
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**



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**Practical based on Paper II**  
**VGUSMZOP402 - (SEMESTER IV)**

<b>List of experiments</b>	
<b>Sr. No.</b>	<b>Description</b>
1	Study of permeability of cell through plasma membrane (Osmosis in blood cells)
2	Measurement of cell diameter by occulometer (by using permanent slide)
3	Qualitative tests for protein (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test)
4	Qualitative test for lipids (Solubility test, Sudan III test)
5	Ultra structure of cell organelles (Electron micrographs) a. Nucleus b. Endoplasmic reticulum (Smooth and Rough) c. Mitochondria. d. Golgi apparatus e. Lysosomes
6	Study of clinical disorders due to carbohydrates, proteins and lipid imbalance (Photograph to be provided / significance to given and disorder to be identified) a. Hyperglycemia, Hypoglycemia. b. Thalassemia, Kwashiorkar c. Obesity, Atherosclerosis

<b>Semester IV – VGUSMZOP402 – Cell Biology (Major)</b>	
<b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks



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**Semester IV – VGVUSMZO402 – Cell Biology (Major)**

**(Internal Class Test Paper Pattern)**

**Duration: 30 minutes**

**Marks: 15**

Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3)

- a)
- b)
- c)
- d)
- e)

05 Marks

Q.2. Write short notes on (1 question from each unit. Any two out of three)

- a)
- b)
- c)

10 Marks



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<b>Semester IV – VGVUSMZO402 – Cell Biology (Major)</b>		<b>(Theory Paper Pattern)</b>
<b>Duration: 2 hrs</b>		<b>Marks: 60</b>
Q.1.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.1.B. Attempt any two a) b) c)		04M 04M 04M
Q.2.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.2.B. Attempt any two a) b) c)		04M 04M 04M
Q.3.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.3.B. Attempt any two a) b) c)		04M 04M 04M
Q.4. Write Short notes on: (All questions are compulsory) a) b) c)		05M 05M 05M

<b>Semester IV – VGVUSMZOP402 – Cell Biology (Major)</b>		<b>(Practical Paper Pattern)</b>
<b>Duration: 3 hrs</b>		<b>Marks: 50</b>
<b>Major Question</b> Q1. Study of permeability of cell through plasma membrane (Osmosis in blood cells). <b>OR</b> Q1. Measurement of cell diameter by occludometer (by using permanent slide)		15 Marks





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**Programme:** S.Y.B.Sc.

**Semester:** IV

**Course:** Zoology- III (For Major)

**Course code:** VGVUSMZO403

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
6	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

**Prerequisite** 1. Basic knowledge about Zoology

2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. To acquaint the learners with key concepts of embryology.
2. To acquaint the learners with different aspects of human reproduction.
3. To make them aware of the causes of infertility, techniques to overcome infertility and the concept of birth control.
4. To acquaint the learners with factors affecting the environment and its conservation strategies.



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**SEMESTER IV**

<b>Course Content</b>			
<b>Unit No.</b>	<b>Module No.</b>	<b>Content</b>	<b>Lectures</b>
<b>VGVSUMZO403 - Embryology, Reproduction and Pollution</b>			
<b>1</b>	I,II,III, IV,V,VI, VII, VIII, IX	<p><b>Comparative embryology</b></p> <p><b>I. Types of Eggs-</b> Based on amount and distribution of yolk</p> <p><b>II. Structure and Types of Sperms</b></p> <p><b>III. Types and Patterns of Cleavages</b></p> <p><b>IV. Types of Blastulae</b></p> <p><b>V. Gastrulation, Morphogenetic movements</b></p> <p><b>VI. Coelom</b> -Formation and types</p> <p><b>VII. Placentation and Types of Placentae</b> -Based on histology, morphology and implantation</p> <p><b>VIII. Extra-embryonic Membranes in Chick</b></p> <p><b>IX. Fate Mapping Techniques</b></p>	<b>10</b>
<b>2</b>	I,II,III, IV	<p><b>Aspects of Human Reproduction</b></p> <p><b>I. Human Reproductive system and Hormonal regulation</b> Anatomy of human male and female reproductive system, Hormonal regulation of Reproduction and Impact of age on reproduction-Menopause and Andropause</p> <p><b>II. Contraception &amp; birth control</b> Difference between contraception and birth control, Natural Methods: Abstinence , Rhythm method, Temperature method, cervical mucus or Billings method, Coitus interruptus, Lactation amenorrhea, Artificial methods : Barrier methods, Hormonal methods, Intrauterine contraceptives, Sterilization, Termination, Abortion</p> <p><b>III. Infertility</b>  <b>Female infertility - Causes</b> - Failure to ovulate; production of infertile eggs; damage to oviducts (oviduct scarring and PID or Pelvic inflammatory disease, TB of oviduct), Uterus (T. B. of uterus and cervix). <b>Infertility associated disorder-</b> (Endometriosis, Polycystic Ovarian syndrome (PCOS), POF (Primary ovarian failure) STDs (Gonorrhoea, Chlamydia, Syphilis and Genital Herpes); Antibodies to sperm; Genetic causes-Recurrent abortions; Role of endocrine disruptors.  <b>Male infertility - Causes</b> : Testicular failure, infections of epididymis, seminal vesicles or prostate, hypogonadism, cryptorchidism , congenital abnormalities, Varicocele,</p>	<b>10</b>



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		<p>Blockage, Azoospermia, Oligospermia, abnormal sperms, autoimmunity, ejaculatory disorders and Idiopathic infertility.</p> <p><b>IV. Treatment of Infertility</b></p> <p>Removal /reduction of causative environmental factors  Surgical treatment, Hormonal treatment- Fertility drugs  Assisted Reproductive Technology (ART)</p> <p>In vitro fertilization, Embryo transfer (ET), Intra-fallopian transfer (IFT), Intrauterine transfer (IUT), Gamete intra- fallopian transfer (GIFT), intra-zygote transfer (ZIFT), Intracytoplasmic sperm injection (ICSI) with ejaculated sperm and sperm retrieved from testicular biopsies – Testicular sperm extraction (TESE), Pronuclear stage transfer (PROST), Sperm banks, cryopreservation of gametes and embryos, Surrogacy.</p>	
<b>3</b>	I,II,III, IV,V, VI, VII	<p><b>Pollution and its effect on organisms</b></p> <p><b>I. Air Pollution</b></p> <p>Types and sources of air pollutant, Effects of air pollution on organisms, its control and abatement measures</p> <p><b>II. Water Pollution</b></p> <p>Types and sources of water pollutant, Effects of water pollution on organisms, its control and abatement measures  Anthropogenic activities: Oil spillage, Radioactive, Sewage, Industrial, Thermal</p> <p><b>III. Soil Pollution</b></p> <p>Types and sources of soil pollutant, Effects of soil pollution on organisms, its control and abatement measures</p> <p><b>IV. Sound pollution</b></p> <p>Different sources of sound pollution, Effects of sound pollution on organisms, its control and abatement measures</p> <p><b>V. Pollution by radioactive substances</b></p> <p><b>VI. Pollution by solid wastes</b></p> <p>Types and sources, Effects of solid waste pollution, its control and abatement measures</p> <p><b>VII. Pollution – Climate Change and Global Warming</b></p>	<b>10</b>
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**





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**Practical based on Paper III**  
**VGUSMZOP404 (SEMESTER IV)**

<b>List of experiments</b>	
<b>Sr. No.</b>	<b>Description</b>
1	Estimation of Dissolved oxygen from the given water sample.
2	Study of physical properties of soil: temperature, moisture and texture
3	Study of chemical properties of soil- pH, organic matter
4	Study of birth control measures applicable to humans – IUD, condom and hormonal pills.
5	Study of the following permanent slides, museum specimens and materials. a. Mammalian sperm and ovum. b. Egg types –Fish eggs, Frog eggs, and Hen's egg. c. Cleavage, blastula and gastrula (Amphioxus, Frog and Bird).
6	Study of natural ecosystem, anthropogenic activities and field report of the visit

<b>Semester IV – VGUSMZOP404 – Embryology, Reproduction and Pollution (Major)</b> <b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks



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<b>Semester IV – VGVUSMZO403 – Embryology, Reproduction and Pollution (Major)</b> <b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks

<b>Semester IV – VGVUSMZO403 – Embryology, Reproduction and Pollution (Major)</b> <b>(Theory Paper Pattern)</b>	
<b>Duration: 2 hrs</b>	<b>Marks: 60</b>
Q.1.A. Attempt any one A) <span style="margin-left: 200px;"><b>OR</b></span> A)	07M  07M
Q.1.B. Attempt any two a) b) c)	04M 04M 04M
Q.2.A. Attempt any one A) <span style="margin-left: 200px;"><b>OR</b></span> A)	07M  07M
Q.2.B. Attempt any two a) b) c)	04M 04M 04M
Q.3.A. Attempt any one A) <span style="margin-left: 200px;"><b>OR</b></span> A)	07M  07M
Q.3.B. Attempt any two a) b) c)	04M 04M 04M



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Q.4. Write Short notes on: (All questions are compulsory)	
a)	05M
b)	05M
c)	05M

<b>Semester IV – VGVUSMZOP404 – Embryology, Reproduction and Pollution (Major)</b> <b>(Practical Paper Pattern)</b>	
<b>Duration: 3 hrs</b>	<b>Marks: 50</b>
<b>Major Question</b>	
Q1. Estimation of Dissolved oxygen from the given water sample	12 Marks
<b>OR</b>	
Q1. Determination of organic matter from the given soil sample.	
<b>Minor Question</b>	
Q2. Determination the pH of the given soil sample	06 Marks
<b>OR</b>	
Q2. Determine the texture of the given soil sample	
Q3. Identify and describe as per instructions:	12 Marks
a. Based on permanent slide	
b. Based on permanent slide	
c. Based on birth control measure	
d. Based on birth control measure	
Q4. Field report and viva based on it	05 Marks
Q5. Viva based on theory	05 Marks
Q6. Certified Journal	10 Marks

<b>Course Outcome</b>
After the completion of the course, students will able to
CO1 understand and compare the different pre-embryonic stages
CO2 appreciate the functional aspects of extra embryonic membranes and classify the different types of placentae.
CO3 understand human reproductive physiology
CO4 correlate different factors responsible for degradation of environment



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**Recommended resources**

1. Developmental Biology- 5<sup>th</sup> Edition, Scot F.Gilbert, Sinauer Associates Inc.
2. Developmental Biology- SubramoniamT.,Narosa Publishers.
3. Developmental Biology-BerrilN.J., Tata Mc Graw –Hill Publication.
4. Essential Reproduction-Martin H. Johnson, Wiley-Blackwell Publication.
5. Chick Embryology- Bradley M. Pattern.
6. Embryology-Mohan P. Arora.
7. Chordate Embryology-Dalela,Verma and Tyagi
8. Human Anatomy and Physiology. E. L. Marieb, Pearson Education Low Price Edition
9. Biological Science. Taylor, Green and Stout. Cambridge Publication
10. Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
11. Human Biology-Daniel D Chiras Jones and Bartlett
12. The Physiology of Reproduction Vol I & II - E.K .Nobil and JU. D.Neil, Raven Press, New York
13. Air Pollution,KudesiaV.P. Pragati Prakasan,Meerut
14. Fundamentals of Air PollutionDaniel A.Vallero,Academic press 5<sup>th</sup> Edition
15. Principles and Practices of Air Pollution Control and Analysis J.R. Mudakanil K
16. International Pub. House Pvt. Ltd.
17. Text Book of Air Pollution and its Control,S.C.Bhatia Atlantic
18. Water Pollution,KudesiaV.P.,Pragati Prakasan,Meerut
19. A text book of Environmental Chemistry and Pollution Control,S.S.Dogra,Swastic Pub, New Delhi
20. Practical Methods for water and Air Pollution Monitoring,S.K.Bhargava,New Age International
21. Hand Book of Water and waste water Analysis,Kanwaljit Kaur,Atlantic
22. Aquatic Pollution by Edward A.Laws
23. Environmental Science and Technology,StanelyE.Manahan
24. Environmental Chemistry,A.K.De, New Age International
25. A Text Book of Environmental Studies,GurdeepR.Chatwal,Harish Sharma,Madhu Arora, Himalaa
26. Svedrup et al., The Oceans.



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**Programme:** S.Y.B.Sc.

**Semester:** IV

**Course:** Zoology- III (For Minor)

**Course code:** VGVUSNZO403

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
2	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

**Prerequisite** 1. Basic knowledge about Zoology

2. Curiosity regarding aspects of the animal kingdom

### Course Objectives

1. To acquaint the learners with key concepts of embryology.
2. To acquaint the learners with different aspects of human reproduction.
3. To make them aware of the causes of infertility, techniques to overcome infertility and the concept of birth control.
4. To acquaint the learners with factors affecting the environment and its conservation strategies.



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**SEMESTER IV**

<b>Course Content</b>			
<b>Unit No.</b>	<b>Module No.</b>	<b>Content</b>	<b>Lectures</b>
<b>VGVUSNZO403 - Embryology, Reproduction and Pollution</b>			
<b>1</b>	I,II,III, IV,V,VI, VII, VIII, IX	<p><b>Comparative embryology</b></p> <p><b>I. Types of Eggs-</b> Based on amount and distribution of yolk</p> <p><b>II. Structure and Types of Sperms</b></p> <p><b>III. Types and Patterns of Cleavages</b></p> <p><b>IV. Types of Blastulae</b></p> <p><b>V. Gastrulation, Morphogenetic movements</b></p> <p><b>VI. Coelom</b> -Formation and types</p> <p><b>VII. Placentation and Types of Placentae</b> -Based on histology, morphology and implantation</p> <p><b>VIII. Extra-embryonic Membranes in Chick</b></p> <p><b>IX. Fate Mapping Techniques</b></p>	10
<b>2</b>	I,II,III, IV	<p><b>Aspects of Human Reproduction</b></p> <p><b>I. Human Reproductive system and Hormonal regulation</b> Anatomy of human male and female reproductive system, Hormonal regulation of Reproduction and Impact of age on reproduction-Menopause and Andropause</p> <p><b>II. Contraception &amp; birth control</b> Difference between contraception and birth control, Natural Methods: Abstinence , Rhythm method, Temperature method, cervical mucus or Billings method, Coitus interruptus, Lactation amenorrhea, Artificial methods : Barrier methods, Hormonal methods, Intrauterine contraceptives, Sterilization, Termination, Abortion</p> <p><b>III. Infertility</b> <b>Female infertility - Causes</b> - Failure to ovulate; production of infertile eggs; damage to oviducts (oviduct scarring and PID or Pelvic inflammatory disease, TB of oviduct), Uterus (T. B. of uterus and cervix). <b>Infertility associated disorder-</b> (Endometriosis, Polycystic Ovarian syndrome (PCOS), POF (Primary ovarian failure) STDs (Gonorrhoea, Chlamydia, Syphilis and Genital Herpes); Antibodies to sperm; Genetic causes-Recurrent abortions; Role of endocrine disruptors. <b>Male infertility - Causes</b> : Testicular failure, infections of epididymis, seminal vesicles or prostate, hypogonadism, cryptorchidism , congenital abnormalities, Varicocele,</p>	10



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		<p>Blockage, Azoospermia, Oligospermia, abnormal sperms, autoimmunity, ejaculatory disorders and Idiopathic infertility.</p> <p><b>IV. Treatment of Infertility</b></p> <p>Removal /reduction of causative environmental factors  Surgical treatment, Hormonal treatment- Fertility drugs  Assisted Reproductive Technology (ART)</p> <p>In vitro fertilization, Embryo transfer (ET), Intra-fallopian transfer (IFT), Intrauterine transfer (IUT), Gamete intra- fallopian transfer (GIFT), intra-zygote transfer (ZIFT), Intracytoplasmic sperm injection (ICSI) with ejaculated sperm and sperm retrieved from testicular biopsies – Testicular sperm extraction (TESE), Pronuclear stage transfer (PROST), Sperm banks, cryopreservation of gametes and embryos, Surrogacy.</p>	
<b>3</b>	I,II,III, IV,V, VI, VII	<p><b>Pollution and its effect on organisms</b></p> <p><b>II. Air Pollution</b></p> <p>Types and sources of air pollutant, Effects of air pollution on organisms, its control and abatement measures</p> <p><b>II. Water Pollution</b></p> <p>Types and sources of water pollutant, Effects of water pollution on organisms, its control and abatement measures  Anthropogenic activities: Oil spillage, Radioactive, Sewage, Industrial, Thermal</p> <p><b>III. Soil Pollution</b></p> <p>Types and sources of soil pollutant, Effects of soil pollution on organisms, its control and abatement measures</p> <p><b>IV. Sound pollution</b></p> <p>Different sources of sound pollution, Effects of sound pollution on organisms, its control and abatement measures</p> <p><b>V. Pollution by radioactive substances</b></p> <p><b>VI. Pollution by solid wastes</b></p> <p>Types and sources, Effects of solid waste pollution, its control and abatement measures</p> <p><b>VII. Pollution – Climate Change and Global Warming</b></p>	10
		<b>Total No. of Lectures</b>	<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**



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**Practical based on Paper III**  
**VGUSNZOP404 (SEMESTER IV)**

List of experiments	
Sr. No.	Description
1	Estimation of Dissolved oxygen from the given water sample.
2	Study of physical properties of soil: temperature, moisture and texture
3	Study of chemical properties of soil- pH, organic matter
4	Study of birth control measures applicable to humans – IUD, condom and hormonal pills.
5	Study of the following permanent slides, museum specimens and materials. a. Mammalian sperm and ovum. b. Egg types –Fish eggs, Frog eggs, and Hen's egg. c. Cleavage, blastula and gastrula (Amphioxus, Frog and Bird).
6	Study of natural ecosystem, anthropogenic activities and field report of the visit
	<b>Only for Minor students</b>
7	Estimation of turbidity of water sample.
8	Estimation of Salinity by refractometer from the given water sample.
9	Estimation of conductivity by conductometer from the given water sample.
10	Detection of pregnancy from given sample of urine.
11	Review writing based on programmes telecasted by Doordarshan, Discovery channel, Gyandarshan, UGC programmes, Animal planet

**Semester IV – VGVUSNZO403 – Embryology, Reproduction and Pollution (Minor)**  
**(Internal Assessment Pattern)**

Duration:	Marks: 40
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks





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<b>Semester IV – VGVUSNZO403 – Embryology, Reproduction and Pollution (Minor)</b> <b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks

<b>Semester IV – VGVUSNZO403 – Embryology, Reproduction and Pollution (Minor)</b> <b>(Theory Paper Pattern)</b>	
<b>Duration: 2 hrs</b>	<b>Marks: 60</b>
Q.1.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.1.B. Attempt any two a) b) c)	04M 04M 04M
Q.2.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.2.B. Attempt any two a) b) c)	04M 04M 04M
Q.3.A. Attempt any one A)	07M
<b>OR</b>	
A)	07M
Q.3.B. Attempt any two a) b) c)	04M 04M 04M





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**Course Outcome**

After the completion of the course, students will able to

CO1 understand and compare the different pre-embryonic stages

CO2 appreciate the functional aspects of extra embryonic membranes and classify the different types of placentae.

CO3 understand human reproductive physiology

CO4 correlate different factors responsible for degradation of environment

**Recommended resources**

1. Developmental Biology- 5<sup>th</sup> Edition, Scot F.Gilbert, Sinauer Associates Inc.
2. Developmental Biology- SubramoniamT.,Narosa Publishers.
3. Developmental Biology-BerrilN.J., Tata Mc Graw –Hill Publication.
4. Essential Reproduction-Martin H. Johnson, Wiley-Blackwell Publication.
5. Chick Embryology- Bradley M. Pattern.
6. Embryology-Mohan P. Arora.
7. Chordate Embryology-Dalela,Verma and Tyagi
8. Human Anatomy and Physiology. E. L. Marieb, Pearson Education Low Price Edition
9. Biological Science. Taylor, Green and Stout. Cambridge Publication
10. Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
11. Human Biology-Daniel D Chiras Jones and Bartlett
12. The Physiology of Reproduction Vol I & II - E.K .Nobil and JU. D.Neil, Raven Press, New York
13. Air Pollution,KudesiaV.P. Pragati Prakasan,Meerut
14. Fundamentals of Air PollutionDaniel A.Vallero,Academic press 5<sup>th</sup> Edition
15. Principles and Practices of Air Pollution Control and Analysis J.R. Mudakanil K
16. International Pub. House Pvt. Ltd.
17. Text Book of Air Pollution and its Control,S.C.Bhatia Atlantic
18. Water Pollution,KudesiaV.P.,Pragati Prakasan,Meerut
19. A text book of Environmental Chemistry and Pollution Control,S.S.Dogra,Swastic Pub, New Delhi
20. Practical Methods for water and Air Pollution Monitoring,S.K.Bhargava,New Age International
21. Hand Book of Water and waste water Analysis,Kanwaljit Kaur,Atlantic
22. Aquatic Pollution by Edward A.Laws
23. Environmental Science and Technology,StanelyE.Manahan
24. Environmental Chemistry,A.K.De, New Age International
25. A Text Book of Environmental Studies,GurdeepR.Chatwal,Harish Sharma,Madhu Arora, Himalaa
26. Svedrup et al., The Oceans.



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**Programme:** S.Y.B.Sc.

**Semester:** IV

**Course:** Human Pathology (SEC)

**Course code:** VGVUSVSZOP405

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Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
	-	2	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

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**Prerequisite**

1. Basic knowledge about Zoology
2. Curiosity regarding aspects of the animal kingdom

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### Course Objectives

1. To enable learners to perform and interpret common clinical laboratory tests relevant to human pathology
2. To enable learners to perform basic hematological procedures accurately and safely
3. To develop the skill to use specialized equipment like spectrophotometers commonly used in clinical laboratories for enzyme activity analysis.



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**Practical based on SEC**  
**VGUSVSZOP405 (SEMESTER III)**

List of experiments	
Sr. No.	Description
1	Estimation of haemoglobin by Sahli's acid haematin method.
2	Enumeration of Erythrocytes – Total Count
3	Enumeration of Leucocytes – Total Count.
4	Determination of serum LDH by using colorimeter/ spectrophotometer.
5	Estimation of blood glucose level from the given sample
6	Estimation of serum/ plasma total triglycerides by Phosphovanillin method.
7	Erythrocyte Sedimentation Rate by suitable method – Westergren or Wintrobe method.
8	Estimation of Aspartate aminotransferase (AST) from the given sample
9	Estimation of Alanine transaminase (ALT) from the given sample
10	Visit to a pathology laboratory/clinical testing centre

Semester IV - VGUSVSZOP405 – Human Pathology (SEC)	
(Practical Paper Pattern)	
<b>Duration: 3 hrs</b>	<b>Marks: 50</b>
<b>Major Question</b> Q.1 Enumerate erythrocytes in the given sample and comment on clinical condition. <p style="text-align: center;"><b>OR</b></p> Q.1 Enumerate leucocytes in the given sample and comment on clinical condition	15 Marks
<b>Minor Question</b> Q.2 Determine blood glucose from the given sample <p style="text-align: center;"><b>OR</b></p> Q.2 Estimate Aspartate aminotransferase from the given sample <p style="text-align: center;"><b>OR</b></p> Q.2 Estimate Alanine transaminase from the given sample <p style="text-align: center;"><b>OR</b></p> Q.2 Determine serum LDH by colorimetric/spectrophotometric method	12 Marks
Q.3 Estimate haemoglobin by Sahli's acid haematin method. <p style="text-align: center;"><b>OR</b></p> Q.3 Estimate serum / plasma total triglycerides by Phosphovanillin method	08 Marks



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<b>OR</b>	
Q.3 Record Erythrocyte Sedimentation Rate by Westergren / Wintrobe method.	
Q.4 Report on visit to pathology laboratory/clinical testing centre	05 Marks
Q.5 Certified Journal	10 Marks

### Course Outcome

After the completion of the course, students will able to

CO1 apply technical skills essential in clinical laboratories

CO2 handle instruments used in pathological settings

CO3 gain skills essential for employability in clinical / diagnostic field.

### Recommended resources

1. Practical Hematology; Dacie J V; Churchill Livingstone; 2006
2. ABC series: ABC of Clinical Haematology; Provan; Drew Publisher: BMJ Books
3. Lehninger's Principles of Biochemistry; David Lee Nelson, A.L. Lehninger, Michael M Cox; 27. W.H. Freeman, New York;2008 28.
4. Biochemistry; 5th ed.; J M Berg, J L Tymoczko and Lubert Stryer; W.H. Freeman, New York; 2002 29.
5. Biochemistry; 2nd edition; Donald Voet and Judith G Voet; J. Wiley and Sons, New York;1995
6. Medical Biochemistry; Fourth Edition; John Baynes &Marek Dominiczak; Saunders (Elsevier);2014



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**Programme:** S.Y.B.Sc.

**Semester:** IV

**Course:** Zoology - Open Elective (for Arts)

**Course code:** VGVUOE407

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Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
2	-	-	2	15	15	10	-	-	60	100
<b>Max. Time, End Semester Exam (Theory) - 2Hrs.</b>										

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**Prerequisite**    1. Basic knowledge about Zoology  
                         2. Curiosity regarding aspects of the animal kingdom

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### Course Objectives

1. To understand the relation between humans and domesticated animals
2. To sensitize learners to the emotions and psychology of animals.
3. To introduce the learners to the history and significance of domesticated animals.



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**SEMESTER IV**

<b>Course Content</b>			
Unit No.	Module No.	Content	Lectures
<b>VGVOE407 - Anthrozoology</b>			
1	I, II, III	<b>Mental lives of animals and animal welfare</b> i) Introduction to anthrozoology ii) Animal rights and welfare iii) Animal cognition and psychopathology	10
2	I, II, III	<b>Zoogeography and animal protection as social movement</b> i) Domesticated animals around the world ii) Pets in prehistory iii) Animal welfare NGOs in India - People for animals (India), Peta, Sanjay Gandhi Animal Care Centre	10
3	I, II, III	<b>Psychology of human - animal interaction and cross cultural anthrozoology</b> i) Animal assisted therapy ii) Animals for sport iii) Roles animal play in different human cultures	10
<b>Total No. of Lectures</b>			<b>30</b>

**Beyond the syllabus**

**Tutorial activities: Student's presentations, Use of E-learning and M-learning, Use of animations.**





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<b>Semester IV – VGVUOE407– Anthrozoology (OE for Arts)</b>	
<b>(Internal Assessment Pattern)</b>	
<b>Duration:</b>	<b>Marks: 40</b>
1. Class Test (Based on theory unit 1,2,3)	15 Marks
2. Assignment	15 Marks
3. Class participation and overall conduct	10 Marks

<b>Semester IV – VGVUOE407– Anthrozoology (OE for Arts)</b>	
<b>(Internal Class Test Paper Pattern)</b>	
<b>Duration: 30 minutes</b>	<b>Marks: 15</b>
Q.1. Fill in the blanks (1 or 2 questions each from unit 1,2,3) a) b) c) d) e)	05 Marks
Q.2. Write short notes on (1 question from each unit. Any two out of three) a) b) c)	10 Marks



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<b>Semester IV – VGVUOE407– Anthrozoology (OE for Arts)</b>		<b>(Theory Paper Pattern)</b>
<b>Duration: 2 hrs</b>		<b>Marks: 60</b>
Q.1.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.1.B. Attempt any two a)		04M
b)		04M
c)		04M
Q.2.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.2.B. Attempt any two a)		04M
b)		04M
c)		04M
Q.3.A. Attempt any one A)	<b>OR</b>	07M
A)		07M
Q.3.B. Attempt any two a)		04M
b)		04M
c)		04M
Q.4. Write Short notes on: (All questions are compulsory) a)		05M
b)		05M
c)		05M



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**Course Outcome**

After the completion of the course, students will able to

CO1 understand the rights and laws pertaining to protection of animals.

CO2 understand the use of pet animals as a part of psychological therapy.

CO3 apply the knowledge and work in NGOs aiming towards the protection of the animals

**Recommended resources**

1. The Animals Among Us by John Bradshaw
2. Hosey, G., & Melfi, V. (Eds.). (2018). Anthrozoology: human-animal interactions in domesticated and wild animals. Oxford University Press.
3. Hurn, S. (2012). Humans and other animals: cross-cultural perspectives on human-animal interactions.



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**Syllabus prepared by -**

- |  |
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| 1. Dr. Vinod R. Ragade: Chairperson, Syllabus Committee<br>Head & Professor,<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai |
| 2. Dr. Preetha Achary<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai  |
| 3. Ms. Veena Menon<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai   |
| 4. Dr. Abhay Morajkar<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai  |
| 5. Mr. Akshay Bagwe<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai  |
| 6. Dr. Sarika Bansode<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai  |
| 7. Dr. Prachi Dandge<br>Dept of Zoology<br>KET'S V. G. Vaze College (Autonomous),<br>Mulund East, Mumbai   |

