Course Structure
MSc Zoology

M.Sc. SEM 1 Zoology									
Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Examination		Total Marks
							Internal	External	
1	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO101DSC	Cell Structure and Functions	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO102DSC	Evolutionary Biology and Genetics	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO103DSC	Molecular Biology and Genetics	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO104DSC	Animal Taxonomy-1	4	0	4	30	70	100
7	Elective Course	MZOO105SE	Wildlife and Conservation Biology	2	0	2	15	35	50
		MZOO106SE	Fisheries and Aquaculture						
		MZOO107SE	Environmentally Sound Technologies-1						
5	PRACTICAL COURSE (PRA)	MZOO101PRA	Lab-1	0	4	3	0	75	75
6	PRACTICAL COURSE (PRA)	MZOO102PRA	Lab-2	0	4	3	0	75	75
		Total		**18**	**8**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY, SIDHPUR

M.Sc. SEM 2 (Zoology)

Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Examination		Total Marks
							Internal	External	
1	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO201DSC	Biochemistry	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO202DSC	Instrumentation and Analytical Techniques	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO203DSC	Biostatistics and Research Methodology	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO204DSC	Animal Taxonomy -2	4	0	4	30	70	100
5	Elective Course	MZOO205SE	Fisheries and Aquaculture -2	2	0	2	15	35	50
		MZOO206SE	Wildlife Biology - 2						
		MZOO207SE	Environmentally Sound Technologies-2						
6	PRACTICAL COURSE (PRA)	MZOO201PRA	Lab-1	0	4	3	0	75	75
7	PRACTICAL COURSE (PRA)	MZOO202PRA	Lab-2	0	4	3	0	75	75
		Total		**18**	**8**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY

M.Sc. SEM 3

Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Examination		Total Marks
							Internal	External	
1	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO301DSC	Animal Physiology	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO302DSC	Immunology and Endocrinology	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO303DSC	Developmental Biology and Evolution	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO304DSC	Advance Techniques in Zoology	4	0	4	30	70	100
7	Elective Course	MZOO305SE	Fisheries and Aquaculture -3	2	0	2	15	35	50
		MZOO306SE	Wildlife Biology- 3						
		MZOO307SE	Environmentally Sound Technologies-3						
5	PRACTICAL COURSE (PRA)	MZOO301PRA	Practical Paper-I	0	4	3	0	75	75
6	PRACTICAL COURSE (PRA)	MZOO302PRA	Practical Paper-II	0	4	3	0	75	75
		Total		**18**	**8**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY

M.Sc. SEM 4

Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Examination		Total Marks
							Internal	External	
1	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO401DSC	Histology, Histochemistry and Parasitology	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO402DSC	Animal Behaviour	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO403DSC	Toxicology and Environmental Biology	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MZOO404DSC	Entomology	4	0	4	30	70	100
7	Elective Course	MZOO405SE	Fisheries and Aquaculture -4	2	0	2	15	35	50
		MZOO406SE	Wildlife Biology- 4						
		MZOO407SE	Environmentally Sound Technologies-4						
5	PRACTICAL COURSE (PRA)	MZOO401PRA	Practical Paper-I	0	4	3	0	75	75
6	PRACTICAL COURSE (PRA)	MZOO402PRA	Practical Paper-II	0	4	3	0	75	75
		Total		**18**	**8**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY, SIDHPUR

Programme Code	MZOO	Programme Name	M.Sc. Zoology
Course Code	MZOO101DSC	Semester	I

Cell Structure and Functions

Course type :	Discipline Specific Course	Total Credit :	04

Teaching time (hours)		Examination Marking scheme		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Cell and cell organells-1**	15	25%
	1.1	Cell wall: Structure and functions; Plasmodesmata: Structure; role in movement of molecules and macromolecules; comparison with gap junctions.		
	1.2	Plasma membrane: Structure, models, and functions; sites for ATPases, ion carriers, channels and pumps; receptors.		
	1.3	Structural organization and function of intracellular organelles: Plastids, Mitochondria, Chloroplast, Golgibodies, Lysosomes, Peroxisomes, Endoplasmic reticulum, Ribosomes		
	1.4	Cytoskeleton- microtubules, microfilamenets and intermediate filaments		
2		**Cell and cell organells-2**	15	25%
	2.1	Nucleus: Structure and functions; nuclear pores; nucleosome organization,Nucleolus		
	2.2	Chromatin organization: Chromosome structure and packaging of DNA, molecularorganization of centromere and telomere		
	2.3	Specialized types of chromosomes: Structure and functions of polytene andlampbrush, B-chromosomes and sex chromosomes		

	2.4	Experimental approaches for studying cells, Cell Fixation and Staining Nucleus: Structure and functions; nuclear pores; nucleosome organization, Nucleolus.		
3		**Cell division and signaling**	**15**	**25%**
	3.1	Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle		
	3.2	Cell Signaling: Cell signaling Hormones and their receptors, cell surface receptor,signaling through G-protein coupled receptors, signal transduction pathways, secondmessengers, regulation of signaling pathways		
	3.3	Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, regulation of hematopoiesis,neurotransmission and its regulation		
	3.4	Apoptosis and Programmed Cell Death (PCD).		
4		**Cytology of cancer**	**15**	**25%**
	4.1	Introduction to cancer biology:Cancer development:Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer.		
	4.2	Cancer propagation: Metastasis, interaction of cancer cells with normal cells.		
	4.3	Cancer treatment: Therapeutic interventions of uncontrolled cell growth.		

Suggested Readings:

1. Lodish*et. al.*, 2007 Molecular Cell Biology, W.H. Freeman and Company, New York, USA
2. Albert*set. al.*, 2008 Molecular Biology of the Cell, Garland Science, Taylor & Francis Group, New York, USA.
3. Sperelakis 2001 Cell Physiology Source Book: A Molecular approach,Academic Press, New York, USA.4.
4. Powar C. B. 1983 Cell Biology, Himalaya Publishing House, Mumbai, India.

Subject Code: MZOO101DSC **Semester: I**
Subject Name: Cell Structure and Functions **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.
CO2	Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
CO3	Students will understand how these cellular components are used to generate and utilize energy in cells
CO4	Students will understand the cellular components underlying mitotic cell division.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO2	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO102DSC**	**Semester**	**I**
Evolutionary Biology and Biodiversity			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

CO3													**2**	-
CO4													**1**	-
CO5														

Unit	Topic	Content	Hours	Weightage
1		**Introduction to Evolutionary Biology**	**15**	**25%**
	1.1	Importance of evolution in biology		
	1.2	A brief history of life..		
	1.3	The development of evolutionary theory Lamarckism, Darwinism, Natural selection, Neo-Darwinism and Mutation theory. Evolution of diseases: some examples		
2		**Variations- nature and types**	**15**	**25%**
	2.1	Mechanisms that decrease and increase variations (natural selection, genetic drift, mutation, recombination and gene flow)		
	2.2	Speciation: Modes of speciation, isolating mechanisms, speciation in time.		
3		**Biodiversity**	**15**	**25%**
	3.1	Genetic, species and ecosystem diversity		
	3.2	Biodiversity at global, national levels.		
	3.3	Biogeographic classification of India, India as a mega diversity nation		
	3.4	Conservation of Biodiversity, insitu and exsitu conservation, Keystone species, measurement of biodiversity.		
4		**Hotspots of Biodiversity**	**15**	**25%**
	4.1	National Parks, Wild life Sanctuaries and Biosphere Reserves		
	4.2	Threats to biodiversity- habitat loss, poaching and man-wildlife conflicts		

	4.3	Endangered and Endemic species of India: Common plant and animal species		
	4.4	Environmental Priorities, strategies and Environmental Legislation (Acts) in India, Environmental Impact Assessment. Bioremediation: Concept need and scope, environmental applications.		

Suggested Readings:

1. Population, Species and Evolution- Ernst Mayr The theory of Evolution- J. Maynard Smith
2. Molecular Evolution and Origin of Life- Widney W. Fox and Klous Dose Animal species and their evolution- A.J. Cain 29+ Evidences for Macroevolution- Douglas Theobald (http://www.talkorigins.org/faqs/comdesc/)
3. Textbook for Environmental Studies- Erach Bharucha, UGC, New Delhi (2004) Environmental Biology- K.C. Agrawal Ecology & Environment- P.D.Sharma
4. Biodiversity- E.O. Wilson The Biology of Diversity- M.Kato The Diversity of Life- E.O. Wilson

Subject Code: MZOO102DSC **Semester: I**
Subject Name: Evolutionary Biology and Biodiversity **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Understand, explain and discuss species distribution patterns and their changes at both local and global scales
CO2	Applying knowledge of ecology and evolution in the management of biodiversity resources, and advising on environmental management issues.
CO3	the specified knowledge, skills, abilities or attitudes that students are expected to attain by the end of a learning experience or program of study.
CO4	Through evolution, we will get information about the inheritance of modern organisms from ancient ones.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO2	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO103DSC**	**Semester**	**I**	
MOLECULAR BIOLOGY AND GENETICS				
Course type :	Discipline Specific Course	**Total Credit :**	4	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Molecular Biology-1**	15	25%
	1.1	Nucleic Acids: Composition of Nucleic Acids and Synthesis of Nucleotides; Molecular Organization and types of DNA and RNA.		
	1.2	DNA Replication in Prokaryotes and Eukaryotes; Enzymes involved in Replication.		
	1.3	Transcription in Prokaryotes and Eukaryotes; RNA Polymerases.		
	1.4	Translation: Process of Protein synthesis.		
2		**Molecular Biology-2**	15	25%
	2.1	Regulation of gene expression in Prokaryotes and Eukaryotes.		
	2.2	Recombinant DNA technology: Classification of Restriction enzymes, Gene Cloning principles and technique		
	2.3	Prokaryotic and Eukaryotic cloning Vectors. Construction of Genomic and cDNA libraries, DNA synthesis and sequencing.		
	2.4	Extra chromosomal inheritance: Male sterility-origin, induction and application, inheritance of chloroplast and mitochondrial gene		
3		**Genetics-1**	15	25%
	3.1	Gene structure and expression: Gene vs allele, a new concept of Allelomorphism, fine structure of gene, cistron, recon and muton.		
	3.2	Genetic code: Deciphering genetic code, properties of genetic code, initiation and termination codons, mutation		
	3.3	Wobble hypothesis, new genetic codes, second genetic code, overlapping and split genes.		

	3.4	Spontaneous and induced mutation, Physical and chemical mutagens; Molecular basis of gene mutations		
4		**Genetics-2**	**15**	**25%**
	4.1	Spontaneous and induced mutation, Physical and chemical mutagens; Molecular basis of gene mutations		
	4.2	Transposable elements in Prokaryotes and Eukaryotes; mutations induced by transposons; site-directed mutagenesis.		
	4.3	Principal of Mendelian Genetics and Hardy – Weinberg genetic equilibrium		
	4.4	Factors affecting gene frequency – Natural selection and Genetic polymorphism and Genetic drift.		

Suggested Readings:

1. Lodishet. al., 2007 Molecular Cell Biology, W.H. Freeman and Company, New York, USA \2.
2. Sambamurty A.V. S. S. 2008 Molecular Biology, Narosa Publishing House, New Delhi.
3. Sandhu G. S. 2002 Molecular Cell Biology, Campus books, New Delhi.
4. Verma P. S. and Agrawal V. K. 2010 Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.

Subject Code: MZOO103DSC **Semester: I**

Subject Name: Molecular Biology and Genetics **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The *student* will gain a basic understanding on human *genetics* and hereditary.
CO2	They learn about DNA, RNA and their replication, mutations, DNA repair mechanism
CO3	Molecular Biology and Genetics covers genomes and the genetics of microorganisms, plants and animals, and the structure and function of cells.
CO4	Through the study of molecular biology, scientists can not only research molecules, but also learn how to manipulate them.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO104DSC**	**Semester**	**I**
ANIMAL TAXONOMY -1			
Course type :	Discipline Specific Course	**Total Credit :**	4
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Introduction to animal body**	15	25%
	1.1	Grades of organization in animal body complexity		
	1.2	Animal body plans		
	1.3	Body cavity and formation of germ layers		
	1.4	Components of metazoan body		
2		**Components of metazoan body**	15	25%
	2.1	History of classification		
	2.2	Species concepts		
	2.3	Major subdivisions of animal kingdom		
	2.4	Classification, characteristics and diversity of Protozoan.		
3		**Classification of non-chordates-1 (up to classes)**	15	25%
	3.1	Introduction to non-chordate phylum		
	3.2	Classification, characteristics and diversity of Porifera		
	3.3	Classification, characteristics and diversity of Cnidaria		
	3.4	Classification, characteristics and diversity of Platyhelminthes		
	3.5	Classification, characteristics and diversity of Nematoda		
4		**Introduction to chordates**	15	25%
	4.1	Introduction to chordate characteristics		
	4.2	Ancestry and evolution of chordates		
	4.3	Classification of chordates (upto class)		
	4.4	Classification, characteristics and diversity of subphylum urochordata and cephlochordata		

Suggested Readings:

1. Sinclair A. R., Fryxell J M and Caughly G. (2006) Wildlife Ecology, Conservation and Management. Blackwell Publishing, U.S.A.

2. Gopal R. (1992) Fundamentals of Wildlife Management. Justice Home, Allahabad, India.

3. Jairajpuri M. S. (1990) Collection and preservation of animals. Zoological Survey of India.

4. Magguran, A.E. (1996). Ecological diversity and its measurements. Princeton University.

5. Gadgil, M. (2002) A methodology mannual for scientific inventorying, monitoring and conservation of Biodiversity

6. Hickman C. P., et al. 2006 Integrated principals of Zoology, McGraw Hill Higher Education. 931pp. 14th edition.

Subject Code: MZOO104DSC **Semester: I**

Subject Name: Animal Taxonomy-1 **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The taxonomy provides an overview of the local fauna and flora, which aids in the identification of endemic species.
CO2	obtaining a suitable specimen (collecting, preserving and, when necessary, making special preparations
CO3	comparing the specimen with the known range of variation of living things;
CO4	correctly identifying the specimen if it has been described, or preparing a description
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO3	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**1**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	M.sc Zoology	
Course Code	**MZOO106SE**	**Semester**	I	
FISHERIES AND AQUACULTURE				
Course type :	Subject Elective	**Total Credit :**	02	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
30	-------	15	35	50

Unit	Topic	Content	Hours	Weightage
1		**Unit -1**		
	1.1	Introduction to fisheries biology	**15**	**50%**
	1.2	External morphology of fish		
	1.3	General characters and classification of fishes		
	1.4	Structural and functional adaptation of fishes		
2		**Unit -2**		
	2.1	History, scope and types of aquaculture	**15**	**50%**
	2.2	Status of aquaculture in India		
	2.3	Fishing crafts and gears		
	2.4	Cultivable fauna and flora in aquaculture		

Suggested readings:

1. Day, F. 1981. Fishes of India, Vol.I and Vol. II. William Sawson& Sons Ltd., London.
2. Jhingran, C.G. 1981. Fish and Fisheries of India. Hindustan Publishing Co., India.
3. Maheswari, K. 1993. Common fish diseases and their control. Institute of FisheriesEducation, Powakads, M.P.
4. Santhanam,R. 1980. Fisheries Science. Daya Publishing House, New Delhi.
5. Yadav, B.N. 1997. Fish and Fisheries. Daya Publishing House, New Delhi
6. FAO Volumes for fish identification.

7. Bal D.V. and Rao, K.V. 1990. Marine Fisheries of India. Tata McGraw HillPublishing Co. Ltd., New York.
8. Biswas, K. P. 1996. A Text Book of Fish, Fisheries and Technology. NarendraPublishing House, Delhi.
9. Srivastava, C.B.L. 1999. Fish Biology. Narendra Publishing House, Delhi.

Subject Code: MZOO106SE **Semester: I**

Subject Name: FISHERIES AND AQUACULTURE **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials.
CO2	Students will learn about certain species' roles in an ecosystem.
CO3	Students will discover that life can be found almost everywhere on earth.
CO4	Students will be able to identify species, characteristics, habitat requirements and life cycles of birds, fish and/or mammalian wildlife species.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**-**	**2**
CO2													**-**	**2**
CO3													**-**	**1**
CO4													**-**	**2**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc Zoology**	
Course Code	**MZOO101PRA**	**Semester**	**I**	
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

CELL BIOLOGY, MOLECULAR BIOLOGY AND GENETICS

Cell Biology:

1. Isolation of mitochondria from given sample
2. Mitosis and the Cell Cycle in Onion Root-Tip Cells
3. Preparation of Buccal smear and Identification of Barr Body
4. Micrometry – Measurement of cell size
5. To measure mitotic index in tissue provided
6. To perform gram stating for identification of gram positive and gram negative bacteria

Molecular Biology and Genetics

7. Spectrometric analysis of DNA
8. Estimation of RNA by Orcinol method
9. Preparation of Drosophila Polytene Chromosome Squashes
10. Construction of normal human karyotype
11. Diagnosis of genetical disorders using karyotypes
12. To study test cross and back cross inheritance related genetic problems
13. Study of human pedigree analysis.

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc Zoology**	
Course Code	**MZOO102PRA**	**Semester**	**I**	
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Biodiversity and Ecology:

1. Determination of different population parameters: a. Density b. Abundance c. Frequency of occurrence d. Dominance
2. Species-area curve method
3. Study of population dynamics using examples a. Population growth rate b. Carrying capacity c. Population doubling time
4. Study and determination of physical and chemical properties of soil
5. Study and determination of physical and chemical properties of water
6. Calculation of similarity and diversity indices for given data
7. Mapping of faunal diversity found in different zoogeographical realms
8. Mapping of protected area and distribution of endangered fauna of India

Animal Taxonomy-1

9. Study of general body organization
10. Study of Classification of protozoans using laboratory specimens.
11. Study of Classification of porifera using laboratory specimens.
12. Study of Classification of cnidaria using laboratory specimens.
13. Study of Classification of platyhelminthes using laboratory specimens.

14. Study of Classification of Nematoda using laboratory specimens.

15. Study of Classification of urochordata and cepahlochordata using laboratory specimens

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code		**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code		**MZOO201DSC**	**Semester**	**II**
Biochemistry				
Course type :		Discipline Specific Course	**Total Credit :**	4
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Fundamentals of Biochemistry**	**15**	**25%**
	1.1	Chemical bonds and Stabilizing interactions: Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction.		
	1.2	Water: weak interactions in aqueous systems, ionization of water, weak acids, and weak bases,		
	1.3	pH and buffer: pH and buffer and Buffering against pH changes in biological systems.		
	1.4	Energy flow: principles of thermodynamics, free energy and chemical potential, redox reactions, structure and function of ATP.		
2		**Biomolecules and Metabolism-1**	**15**	**25%**
	2.1	Carbohydrates: Classification, Occurrence, Structure, properties and functions of Monosaccharides (Triose, Pentose and Hexose), Disaccharides and Polysaccharides (Starch, glycogen and Cellulose).		
	2.2	Carbohydrate metabolism: Glycolysis, Glycogenesis, TCA cycle, Electron transport system, Oxidative phosphorylation and photophosphorylation, Hexose monophosphate shunt.		
	2.3	Lipids: Classification of Lipids, Occurrence, Structure, properties and Function of Simple lipids (Triglycerides and Waxes) and Complex lipids (Phospholipids and Sphingolipids).		
	2.4	Lipid metabolism: Biosynthesis of fatty acids and Phospholipids, Catabolism of fatty acids and β- Oxidation of fatty acids.		

3		**Biomolecules and Metabolism-2**	**15**	**25%**
	3.1	Amino Acids: Structure, Properties, and Classification of Amino Acids.		
	3.2	Amino acid metabolism: Biosynthesis and break down of amino acids, transamination and deamination.		
	3.3	Protein: Classification of Proteins, properties, Function and Conformation of Proteins (primary, secondary, tertiary and quaternary structure), Ramachandran Plot, protein domains and folds, Protein denaturation and stability		
	3.4	Interrelationship between metabolism of Carbohydrate, Lipid and Protein.		
4		**Enzymes and Vitamins**	**15**	**25%**
	4.1	Enzymes: An introduction to Enzymes, Nomenclature, Classification of Enzymes. Properties of enzymes, Apo-enzymes, coenzymes, cofactors and prosthetic groups.		
	4.2	Mechanisms of enzyme action, Kinetics of an enzyme- catalyzed reaction and inhibition.		
	4.3	Enzyme regulation: Allosteric enzyme regulation, Covenant modification.		
	4.4	Vitamins: Occurrence, Classification, Structure and function of various Vitamins and their deficiency diseases.		

Suggested Readings:

1. Harper H. A. 1993 Review of Physiological Chemistry (Lange Publications).
2. Lehninger A. l., Nelson D. L. and Cox M.M. 1993. Principles of Biochemistry (CBCPublishers).
3 Rastogi S. C. 2003 Biochemistry (Tata Mc GrawHill Publishing Co. Ltd.).

Subject Code: MES201DSC **Semester: II**

Subject Name: Environmental Chemistry **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	It is important to study environmental chemistry as it helps in understanding and solving various environmental issues.
CO2	Environmental Chemistry works together to give information for threat assessment, repair research, and establishing the level of environmental management needed for the entire system
CO3	Students will gain an understanding of: chemical reactions and strategies to balance them. the relative quantities of reactants and products. the fundamental properties of atoms, molecules, and the various states of matter
CO4	Environmental Chemists are therefore often the more public-facing chemists, as the research they conduct helps inform decisions that affect all of us.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**		**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO202DSC**		**Semester**	**II**
INSTRUMENTATION AND ANALYTICAL TECHNIQUES				
Course type :	Discipline Specific Course		**Total Credit :**	4
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Basic Laboratory Instruments**	15	25%
	1.1	Principle and working of pH meter, Laminar-air flow		
	1.2	Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges, differential centrifugation, sedimentation velocity, sedimentation equilibrium, density gradient methods and their applications.		
2		**Chromatographic and Electrophoresis Techniques**	15	25%
	2.1	Principle and applications of Native-PAGE, SDS-PAGE, Agarose and 2D gel Electrophoresis. Capillary electrophoresis and its applications.		
	2.2	Principle, methodology and applications of gel – filtration, ion – exchange and affinity Chromatography; Thin layer and High Performance Thin Layer Chromatography (HPTLC). Gas chromatography, High performance liquid chromatography (HPLC)and FPLC.		
3		**Spectroscopy and Microscopy**	15	25%
	3.1	Spectroscopy Technique: Principle and application of UV- visible spectrometer, AAS and Plasma Emission Spectroscopy.		
	3.2	Mass Spectroscopy: Principle of MALDI, Types of Detectors		
	3.3	Microscopic Techniques:Principle and applications of Light, Phase contrast and Fluorescence Microscopy, Principle and applications of SEM and TEM		
4		**Immuno Techniques and Radio-isotopic Technique**	15	25%

	4.1	Antibody generation, detection of molecules using ELISA, RIA, Western blot,immunoprecipitation, Immunofluorescence microscopy, detection of molecules in living cells- in-situ localization by FISH.		
	4.2	Principle and applications of Flow cytometry.		
	4.3	Radiolabeling techniques: Properties of different types of radioisotopes used in Biology, their detection and measurement, Autoradiography.		

Suggested Readings:

1. Wilson, K. and Walker, J., (2010). Principles and Techniques of Biochemistry andMolecular Biology, 7th edition, Cambrige University Press (Low price edition), NewYork.
2. Webster J. G., (2009). Bioinstrumentation, Student edition, Wiley India (P) Ltd. NewDelhi.
3. Sharma, B. K., (2005). Instrumental methods of chemical analysis, 24th edition,GOEL publishing house, Meerut.

Subject Code: MES202DSC **Semester: II**
Subject Name: INSTRUMENTATION AND ANALYTICAL TECHNIQUES **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	It is important to study environmental chemistry as it helps in understanding and solving various environmental issues.
CO2	Environmental Chemistry works together to give information for threat assessment, repair research, and establishing the level of environmental management needed for the entire system
CO3	Students will gain an understanding of: chemical reactions and strategies to balance them. the relative quantities of reactants and products. the fundamental properties of atoms, molecules, and the various states of matter
CO4	Environmental Chemists are therefore often the more public-facing chemists, as the research they conduct helps inform decisions that affect all of us.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO203DSC**	**Semester**	**II**
BIOSTATISTICS AND RESEARCH METHODOLOGY			
Course type :	Discipline Specific Course	**Total Credit :**	4
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Biostatistics and Research Methodology**	15	25%
	1.1	Definition and scope, Organizing a statistical survey and presentation of statistically analyzed information		
	1.2	Basic statistical methods: Measures of central tendency, dispersion and standard error; Probability distributions: binomial, poisson and normal distribution		
	1.3	Statistical significance: Hypothesis testing, types of error, level of significance, Student's t test, F test and Chi square goodness of fit		
	1.4	Simple linear regression and correlation analysis		
2		**Non parametric statistics**	15	25%
	2.1	Comparing Parametric and Non parametric statistics, Rank test, F-max test, Mann – Whitney (U) test, and Sign test		
	2.2	Applications of non-parametric statistics in biological research		
	2.3	Basic computing: MS Office ®, Internet		
	2.4	Data base management, Use of computers in statistical analysis		
3		**Research methodology**	15	25%
	3.1	Characteristics and types of scientific research		
	3.2	Basics of research methodology		
	3.3	Research and Experimental design		
	3.4	Method of Data collection		

4		**Scientific deliveries**	**15**	**25%**
	4.1	Scientific Deliveries and Communications: Writing Research proposal, Paper, Thesis, Report and Citations		
	4.2	Citations, H-Index, I10-Index, Impact factor and selection criteria of scientific journals for research publications		
	4.3	Presenting scientific research: Power point presentations, Posters, Flyers, etc.		
	4.4	Publication processes, Review Processes and Significance of scientificCommunications		

Suggested Readings:

1. Milton, J.S 1992 Statistical Methods in Biological and Health Science. McGraw-Hill Inc, New York.
2. Schefler, W.C. 1963 Statistics for biological sciences. Addition – Wesely Publication Co., London.
3. Snedecor, G. Wand Cocham, W. G. 1967 Statistical Methods. Oxford Publication Co., New Delhi.
4. Spiegel, M.R. 1981 Theory and problems of statistics, Schaum's Outline Series McGraw –Hill International Book Co., Singapore.
5. Day R.A. 7th Edition. How to write and publish a scientific paper

Subject Code: MES203DSC **Semester: II**

Subject Name: Solid waste management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Minimize the Production of Waste. Proper management practices help minimize the garbage and scraps that need handling
CO2	Reduce Pollution Effects. Secondly, it's vital to lower the impact garbage has on pollution.
CO3	Waste management is aimed to reduce the adverse effects of waste on environment, health and the beauty of nature.
CO4	Make physical and chemical analysis of municipal solid wastes and apply them for a management system that will be set up. make route optimization for a solid waste collection and transport system.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	-	-	-	-	**2**	**2**	-		
CO2	**2**	**1**	**2**	-	-	-	-	**1**	**1**	-		
CO3	**3**	**2**	**2**	-	-	-	-	**2**	**2**	-		
CO4	**2**	**1**	**1**	-	-	-	-	**1**	**1**	-		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	-
CO2													**2**	-
CO3													**3**	-
CO4													**1**	-
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO204DSC**	**Semester**	**II**	
ANIMAL TAXONOMY -2				
Course type :	Discipline Specific Course	**Total Credit :**	4	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Classification of non-chordates-2 (up to classes)**	15	25%
	1.1	Classification, characteristics and diversity of Annelida		
	1.2	Classification, characteristics and diversity of Mollusca		
	1.3	Classification, characteristics and diversity of Arthropoda		
	1.4	Classification, characteristics and diversity of Echinodermata.		
	1.5	Classification, characteristics and diversity of Hemichordata		
2		**Introduction to vertebrates-1**	15	25%
	2.1	Classification and characteristics of subphylum vertebrata		
	2.2	Classification, characteristics and diversity of different classes of fishes		
	2.3	Structural and functional adaptation of fishes		
	2.4	Evolution of terrestrial vertebrates		
3		**Introduction to vertebrates-2 (up to order)**	15	25%
	3.1	Classification, characteristics and diversity of class amphibia		
	3.2	Classification, characteristics and diversity of class reptilian		
	3.3	Classification, characteristics and diversity of class Aves		
	3.4	Classification, characteristics and diversity of class mammals		
4		**Methods inTaxonomy**	15	25%
	4.1	Zoological nomenclature and ICZN rules and regulation		
	4.2	Type concept		
	4.3	DNA barcoding of animal species		
	4.4	Procedure of collection, preservation and identification of species		

Suggested Readings:

1. Hickman C. P., et al. 2006 Integrated principals of Zoology, McGraw Hill Higher Education. 931pp. 14th edition.
2. Ekambarantha Ayyar, M and T.N. Ananthakrishnan. 1992. A manual of Zoology Vol. II[Chordata]. S. Viswanaathan (Printers and Publishers] Pvt. Ltd., Madras.
3. Jordan E.L. and P.S. Verma 1995. Chordata Zoology and Elements of Animal Physiology. S. Chand and Co., New Delhi.
4. Kotpal R.L. 1992. Vertebrata, Rastogi Publications, Meerut

Subject Code: MES204DSC **Semester: II**

Subject Name: Disaster management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
CO2	If the students are properly trained, they can rush to the disaster spot and can help the disaster management team for quick rehabilitation and resettlement of victims at times of floods, earthquakes and drought etc.
CO3	Disaster education aims to provide knowledge among individuals and groups to take actions to reduce their vulnerability to disasters.
CO4	After studying this course, you should be able to: understand what is meant by management and managerial effectiveness. identify the roles which are fulfilled while working as a manager. identify managerial activities that contribute to managerial effectiveness.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**2**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	M.sc Zoology
Course Code	**MZOO206SE**	**Semester**	II
WILDLIFE BIOLOGY - 2			
Course type :	Subject Elective	**Total Credit :**	02
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
30	-------	15	35	50

Unit	Topic	Content	Hours	Weightage
1		**Unit -1**		
	1.1	Estimating number of wildlife (Census techniques)	**15**	**50%**
	1.2	Measuring habitat use and occupancy		
	1.3	Wildlife habitat evaluation techniques		
	1.4	Wildlife population monitoring techniques		
2		**Unit -2**		
	2.1	Human-wildlife Interaction	**15**	**50%**
	2.2	Management and mitigation of conflicts		
	2.3	Conservation outreach programmes		
	2.4	Immobilization and rescue of wildlife		

Suggested readings:

1. T A Bookhout 1996. Research and Management Techniques for Wildlife and Habitats. The Wildlife Society, ML
2. D E Wilson 2002. Measuring and Monitoring Biological Diversity: Standard Methods. The Smithsonian Institution, USA
3. J P Sands et al. 2012. Wildlife Science: Connecting Research with Management. CRCPress, Taylor and Francis Group

Subject Code: MZOO206DSE **Semester: II**

Subject Name: WILDLIFE BIOLOGY 2 **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials.
CO2	Students will learn about certain species' roles in an ecosystem.
CO3	Students will discover that life can be found almost everywhere on earth.
CO4	Students will be able to identify species, characteristics, habitat requirements and life cycles of birds, fish and/or mammalian wildlife species.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**-**	**2**
CO2													**-**	**2**
CO3													**-**	**1**
CO4													**-**	**2**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.sc Zoology**	
Course Code	**MZOO201PRA**	**Semester**	**II**	
BIOCHEMISTRY, INSTRUMENTATION AND ANALYTICAL TECHNIQUES				
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Biochemistry

1. Estimation of reducing and non-reducing sugars from given sample
2. Estimation of total carbohydrates from given tissue sample
3. Estimation of glycogen from given tissue sample
4. To estimate total protein content from given tissue sample
    a. Folin-lawry method
    b. Bradford method
5. Colorimetric quantification of amino acids by Ninhydrin method
6. Estimation of ascorbic acid from given tissue sample
7. Estimation of total lipid content from given tissue samples
8. Estimation of cholesterol content from given tissue samples
9. Enzymatic assay of Catalase, peroxidase etc.

Instrumentation and analytical Techniques

10. Agarose gel electrophoresis
11. Preparation of native and SDS-PAGE
12. Thin Layer chromatography

13. Paper chromatography

14. Principle and application of Instruments available in your department

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**		**Programme Name**	**M.sc Zoology**
Course Code	**MZOO202PRA**		**Semester**	**II**
BIOSTATISTICS, RESEARCH METHODOLOGY AND ANIMAL TAXONOMY -2				
Course type :	Practical		**Total Credit :**	03
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Biostatistics

1 Computation of different measures of central tendency

a. Arithmetic Mean

b. Harmonic Mean

c. Geometric Mean

d. Median

e. Mode

2 Computation of various measures of dispersion

a. Range and Co efficient of Range

b. Mean Deviation

c. Standard Deviation

3 Estimating standard error and coefficient of variation

4. Estimating confidence intervals for population mean

5 To perform Student's t test

a. Paired t test

b. Unpaired t test

6 To perform single factor Analysis of Variance (ANOVA) or F test

7 To study and perform regression analysis and prediction of future events

8 To study and perform correlation analysis

9 To perform Chi Square test of goodness of fit

10 To perform different non-parametric test

a. Sign test

b. Rank test

c. F max test

d. U test

Research Methodology

1 Defining Goal, Objectives, Stakeholders and parameters of research

2 Risk identification and analysis

3 Scientific writing practice –I (Log frame and Review writing)

4 Scientific writing practice –II (Citation)

5 Scientific reference management

Notes:

1. *All the calculations of examples have to perform through manual method*

2. *For each experiment, perform 3-4 examples*

3. *Write your interpretation of data analysis and then write your conclusion*

Animal Taxonomy-2

1. Study of Classification of annelida using laboratory specimens.

2. Study of Classification of mollusca using laboratory specimens.

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO301DSC**	**Semester**	**III**	
Animal Physiology				
Course type :	Discipline Specific Course	**Total Credit :**	04	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70	100

Unit	Topic	Content	Hours	Weightage
1		**Physiology of digestion, respiration and circulation**	15	25%
	1.1	Physiology of digestion		
	1.2	Physiology of respiration		
	1.3	Composition of blood		
	1.4	Myogenic heart, cardiac cycle and ECG		
2		**Physiology of muscles, neurons and sensory mechanism**	15	25%
	2.1	Types and functions of muscles, process of contraction and relaxation of muscles		
	2.2	Anatomy of central and peripheral nervous system;neurotransmitters and their physiological functions.		
	2.3	Types and functions of receptors: photoreceptors, chemoreceptors, mechanoreceptors, thermoreceptors.		
3		**Physiology of urino-genital system and thermoregulation**	15	25%
	3.1	Excretory organs: anatomy and physiology		
	3.2	Reproductive organs: anatomy and physiology		
	3.3	Menstrual cycle, physiology of pregnancy		
	3.4	Thermoregulatory organs and their function		
4		**Physiological disorders**	15	25%
	4.1	Disorders of digestive and respiratory system		
	4.2	Hematological and cardiac disorders		

	4.3	Muscular and neuronal disorders		
	4.4	Disorders of urino-genital systems		

Suggested Readings:

1) Bell, G.E. Davidson, J.N. and Emslie D. (1922) Smith Text Book of Physiology & Biochemistry
2) Dayson, (1964) A Text Book of General Physiology: Little Brown & Co. Boston.
3) Eckert R. and Randall D. (1983) Animal Physiology: 2nd Edn. W.H. Rexeman & Co.
4) Guyton, A.G. (1968) Textbook of Medical Physiology: 7th Edn. Saunders Pub.
5) Ganong W.F. (1981) Medical Physiology: 10th Edn. Lange Medical Publications.
6) Tortora Grabowski Principles of Anatomy and Physiology:, 9th Edn. John Willey &Sons.

Subject Code: MES301DSC **Semester: III**
Subject Name: Environmental health &Disaster management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
CO2	If the students are properly trained, they can rush to the disaster spot and can help the disaster management team for quick rehabilitation and resettlement of victims at times of floods, earthquakes and drought etc.
CO3	Disaster education aims to provide knowledge among individuals and groups to take actions to reduce their vulnerability to disasters.
CO4	After studying this course, you should be able to: understand what is meant by management and managerial effectiveness. identify the roles which are fulfilled while working as a manager. identify managerial activities that contribute to managerial effectiveness.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**2**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO302DSC**	**Semester**	**III**
Immunology and Endocrinology			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70	100

Unit	Topic		Hours	Weightage
1		**Introduction to immune system**	15	25%
	1.1	Introduction and history of immunology.		
	1.2	Organs and cells of immune system.		
	1.3	Antigen, antibody and their reactions.		
	1.4	Types of immunity- innate, adaptive, humoral mediated and cell mediated.		
2		**Reactions of immune system**	15	25%
	2.1	Complement system: classical and alternative pathways.		
	2.2	Major histocompatibility complex (MHC) structure and function.		
	2.3	Cytokines and cytokine receptors.		
	2.4	hypersensitivity and autoimmune diseases.		
	2.5	AIDS		
3		**Introduction to endocrinology**	15	25%
	3.1	Brief history of endocrinology		
	3.2	Hormones and neuroendocrine integration in homeostasis		
	3.3	Hormone synthesis		
	3.4	Hormone circulation and metabolism		
4		**Endocrine glands and their hormones**	15	25%
	4.1	Nervous system hormones (hypothalamus, pituitary and pineal)		
	4.2	Thyroid and parathyroid gland and its hormones		
	4.3	Pancreas and its hormones		
	4.4	Adrenal gland and its hormones, Reproductive hormones		

	4.5	Gastro-Intestinal hormones and their functions.		

References

1) Richard, Thomas, Barbara, Janis (2005) Kuby Immunology, W. H. Freeman and company, New York, USA.
2) Janeway, Travers, Walport and Shlomchik (2005) Immuno Biology- The immunesystem in health and disease, Garland Science Publishing, New York, USA.
3) David, Brostoff and Roitt (2006) Immunology, (7th Ed., 2006), Mosby & ElsevierPublishing, Canada, USA.
4) Mac Hadley. 1992. Endocrinology, 3 rd Edition. Prentice – Hall Inc. A Simon &Schuster Company, Englewood Cliffs, New Jersey. USA.
5) Ingleton, P.M. and Bangara, J.T. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.
6) Turner, C.D. and Bangara, J.T. 1986. General endocrinology. Saunders International Student edition. Toppan Company Limited. Tokyo.

Subject Code: MES302DSC **Semester: III**

Subject Name: Environmental monitoring & management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Environmental monitoring is a tool to assess environmental conditions and trends, support policy development and its implementation, and develop information for reporting to national policymakers, international forums and the public.
CO2	The main objective of environmental monitoring is to manage and minimize the impact an organization's activities have on an environment
CO3	Ither to ensure compliance with laws and regulations or to mitigate risks of harmful effects on the natural environment and protect the health of human beings.
CO4	The Environment Management Plan (EMP) identifies feasible and cost-effective measures that have the potential to reduce potentially significant negative environmental impacts to acceptable levels.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO303DSC**	**Semester**	**III**	
Developmental Biology and Evolution				
Course type :	Discipline Specific Course	**Total Credit :**	4	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Introduction to developmental biology**	15	25%
	1.1	History and basic concept of developmental biology		
	1.2	Gametogenesis: spermatogenesis and oogenesis		
	1.3	Fertilization, Parthenogenesis		
	1.4	Early developmental process: cleavage and formation of blastula, gastrulation, neural tube formation, cell migration		
2		**Axis formation, limb development and hormonal control**	15	25%
	2.1	Genetics of axis formation in drosophila		
	2.2	General concept of organogenesis: development of chick limb		
	2.3	Regeneration in animals: Epimorphosis and morphallaxis		
	2.4	The biology of ageing		
3		**Introduction to evolution**	15	25%
	3.1	Brief history of evolution, Direct and indirect evidences of evolution		
	3.2	Experiments about origin of life: Miller-Urey experiment, Oparin-Haldane hypothesis		
	3.3	Theories of evolution		
	3.4	Gene pool, gene frequency, genetic drift and founder effect		
4		**Processes of evolution**	15	25%
	4.1	Types of isolation, speciation		
	4.2	Adaptive radiation, Micro, macro and Mega evolution		

	4.3	Geological time scales and evolution of different faunal groups		
	4.4	Human evolution		

Suggested Readings:

1) Riddle M. (1996) Evolution. 2nd edn. Blackwell.
2) Piyanka E.R. (1994) Evolutionary Ecology 5th edn Harper Collins
3) Verma P. S. and Agrawal V. K. 2010 Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.
4) Gilbert, (2006) Developmental Biology, Sinauer Associates Inc., Massachusetts, USA. 2
5) Wolpert (2006) Principles of Development, Beddington, Brockes, Jessell, Lawrence, Meyerowitz, (3rd Ed., 2006), Oxford University Press, New Delhi, India.
6) Kalthoff (2000) Analysis of Biological Development, McGraw-Hill Science, New Delhi, India.

Subject Code: MZOO303DSC **Semester: III**

Subject Name: Developmental Biology and Evolution **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	GIS makes it easy to monitor the environment using satellite images. Satellite images help monitor the natural resources, soil, and habitat of different species.
CO2	With the help of GIS, an organization can observe the distribution of different species and use this information to allocate funds for the species.
CO3	Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis.
CO4	Recent advances in remote sensing technology have enabled researchers to gain a more comprehensive understanding of the environment. Through satellite imagery, researchers can observe changes in land cover, vegetation and water levels, track the spread and intensity of wildfires, and assess the movement of species.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO304DSC**	**Semester**	**III**	
Advance Techniques in Zoology				
Course type :	Discipline Specific Course	**Total Credit :**	4	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70	100

Unit	Topic	Content	Hours	Weightage
1		**Techniques for biodiversity assessment**	15	25%
	1.1	Quantitative assessment of biodiversity: different types of transects, quadrates and data analysis.		
	1.2	Population census techniques for vertebrates.		
	1.3	Invertebrate sampling techniques		
	1.4	Phylogenetic analysis of DNA sequences.		
2		**Remote Sensing and Applications**	15	25%
	2.1	Introduction to remote sensing, History and scope		
	2.2	Energy sources and EMR, RS sensors and platforms		
	2.3	Image processing and classification		
	2.4	Land cover and Land use analysis, Analysis of spatial data		
	2.5	RS applications in different fields		
3		**GIS Basics**	15	25%
	3.1	Fundamentals of GIS and functions of GIS		
	3.2	Software for GIS (GIS lab)		
	3.3	Spatial data models		
	3.4	Presentation of GIS data		
4		**GIS Applications**	15	25%
	4.1	Ecological modeling through GIS		
	4.2	Species distribution models		
	4.3	Fragmentation analysis		

	4.4	Applications of GIS		

References

1) Krishnamurthy K. V. 2003 An Advanced Textbook on Biodiversity Principles and Practice. Oxford & IBH Publishing C. Pvt. Ltd. New Delhi.
2) Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety and Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Subject Code: MZOO304DSC **Semester: III**

Subject Name: Advance Techniques in Zoology **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	provide cures for diseases that kill certain species or to develop improvements to enclosed habitats that will deliver a better quality of life for the animals.
CO2	Understand the basic theories and principles of techniques
CO3	To promote training in practical and conceptual skills in sub-disciplines ranging from molecular cell biology, through physiology and Endocrinology, to the study of populations in both an ecological and evolutionary framework.
CO4	provide cures for diseases that kill certain species or to develop improvements to enclosed habitats that will deliver a better quality of life for the animals.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**1**	-	-	-	-	**1**	**1**	-		
CO2	**1**	**2**	**2**	-	-	-	-	**1**	**1**	-		
CO3	**2**	**1**	**1**	-	-	-	-	**2**	**2**	-		
CO4	**1**	**2**	**1**	-	-	-	-	**2**	**1**	-		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	
CO2													**1**	
CO3													**2**	
CO4													**1**	
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	M.sc Zoology	
Course Code	**MZOO306SE**	**Semester**	III	
Wildlife Biology- 3				
Course type :	Subject Elective	**Total Credit :**	02	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
30	-------	15	35	50

Unit	Topic	Content	Hours	Weightage
1		**Wildlife Research and Monitoring**		
	1.1	Conventional Research & Monitoring techniques	**15**	**50%**
	1.2	Advanced research & Monitoring techniques		
	1.3	Camera trapping		
	1.4	Radio telemetry		
2		**Advances in wildlife Research**		
	2.1	Noninvasive conservation genetics	**15**	**50%**
	2.2	Wildlife research case studies		
	2.3	Use of information technology in wildlife research (*in silico* wildlife research)		
	2.4	Citizen science approach and Wildlife forensics.		

References

1) Sinclair A. R., Fryxell J M and Caughly G. (2006) Wildlife Ecology, Conservation and Management. Blackwell Publishing, U.S.A.
2) Gopal R. (1992) Fundamentals of Wildlife Management. Justice Home, Allahabad, India.
3) Jairajpuri M. S. (1990) Collection and preservation of animals. Zoological Survey of India.
4) Magguran, A.E. (1996). Ecological diversity and its measurements. Princeton University.
5) Gadgil, M. (2002) A methodology mannual for scientific inventorying, monitoring and conservation of Biodiversity
6) Hickman C. P., et al. 2006 Integrated principals of Zoology, McGraw Hill Higher Education. 931pp. 14th edition.

Subject Code: MZOO306SE **Semester: III**

Subject Name: Wildlife Biology - 3 **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials.
CO2	Students will learn about certain species' roles in an ecosystem.
CO3	Students will discover that life can be found almost everywhere on earth.
CO4	Students will be able to identify species, characteristics, habitat requirements and life cycles of birds, fish and/or mammalian wildlife species.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	-	-	-	-	**2**	**2**	-		
CO2	**1**	**2**	**2**	-	-	-	-	**1**	**2**	-		
CO3	**2**	**3**	**2**	-	-	-	-	**1**	**2**	-		
CO4	**2**	**2**	**1**	-	-	-	-	**2**	**1**	-		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													-	**2**
CO2													-	**2**
CO3													-	**1**
CO4													-	**2**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc Zoology**	
Course Code	**MZOO301PRA**	**Semester**	**III**	
Animal Physiology, Immunology and Endocrinology				
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Animal Physiology

1. Total RBC count in blood sample.
2. Total WBC count in blood sample
3. Estimation of bleeding and clotting time.
4. Hemoglobin estimation in blood sample
5. Differential count of leucocytes.
6. Determination of blood group of given blood sample.

Immunology and Endocrinology

7. To study location of endocrine glands in animal body using charts
8. To study histology of endocrine glands using permanent slides.
9. To study various endocrine disorders via power point slide or photographs.
10. Preparation of report on prevalence of different endocrine diseases in Patan city.
11. Introduction to immunological test carried out in pathology laboratory.
12. Histology of lymphoid organs using permanent slides/charts
13. Effect of various digestive enzymes.
14. Study of haemin crystals.

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc Zoology**	
Course Code	**MZOO302PRA**	**Semester**	**III**	
Developmental Biology and Evolution, Applied Zoology				
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Developmental Biology and Evolution

1. To study stages of gametogenesis using slides or charts.
2. To study embryonic development in fish, frog and chick using charts.
3. Study of different developmental stages of chick embryo using permanent slides or charts.
4. To study various larval stages of Arthropods.
5. To study various larval stages of Echinoderms.
6. To study evolution of heart in different vertebrates.
7. To study evolution of brain in different vertebrates.
8. Study of fossils.
9. Study of human evolution.

Applied Zoology

10. Calculation of examples of Hardy-Weinberg principle
11. Generation of GIS enabled files.
12. Geo-referencing of toposheets.
13. Construction of a maps on the GIS platform
14. Data extraction using GIS
15. Processing & classification of satellite image

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO401DSC**	**Semester**	**IV**
Histology, Histochemistry and Parasitology			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs) / **Practical** (hrs)		**Internal** (Marks)	**External** (Marks) / **Total** (Marks)
60	-------	30	70 / 100

Unit	Topic	Content	Hours	Weightage
1		**Histological Techniques**	15	25%
	1.1	Introduction to histology and histochemistry		
	1.2	Tissue processing, fixation and microtomy		
	1.3	Staining methods: acid, basic, neutral and vital stains and various histochemical stains		
	1.4	Staining of frozen and paraffin sections		
2		**Histology of body tissue**	15	25%
	2.1	Introduction to types of body tissue		
	2.2	Histology of Epithelial tissue and connective tissue		
	2.3	Histology of muscle, bones and cartilage		
	2.4	Histology of digestive system tissues (tongue, oesophagus, stomach, large intestine, pancreas, liver) and nervous tissue		
3		**Parasitology 1**	15	25%
	3.1	Introduction Parasitology		
	3.2	Types of hosts and parasites		
	3.3	Food and water-borne bacterial diseases		
	3.4	Sexually transmitted bacterial diseases		
4		**Parasitology 2**	15	25%
	4.1	Parasitic protozoans and human diseases		
	4.2	Parasitic trematoda, cestoda and human diseases		
	4.3	Parasitic nematode and human diseases		
	4.4	Parasitic mites, ticks and their control		

Suggested Readings:

1) Bloom and Fawcett. D. 1972 Text book of histology 10th ed. 3.
2) David H.C. 1987 Histology 9th ed. (Horper International Pub)
3) McManus J.F.A. and Mowry R.W. 1960 Staining methods.
4) Cheng T.C. (1964) The Biology of animal parasites, Saunders International Student Edition
5) Panikar C.K.J (1988) 5. The Parasitology of Trematodes Oliver and Boyd Ltd. Edinburgh.
6) Sood Pamnik (1993) Parasitology (Protozoology and Helminthology) CBS Publication and Distrubution, Delhi.

Subject Code: MZOO401DSC **Semester: IV**

Subject Name: Histology histochemistry and parasitology **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The fundamental aim of histology is to determine how tissues are organized at all structural levels, from cells and intercellular substances to organs.
CO2	What is the importance of studying histology in medicine? Histology can help students gain a better understanding of cell behavior and reproduction, making cellular biology more understandable.
CO3	The study of histology is essential for medical students in multiple ways.
CO4	It helps students understand the arrangement of cells and tissues in a normal organ system. Moreover, it correlates the structure to function by correlating the differentiation of tissue structure to their specific function
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO2	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO402DSC**	**Semester**	**IV**	
Animal Behaviour				
Course type :	Discipline Specific Course	**Total Credit :**	04	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Introduction to animal behaviour**	15	25%
	1.1	Introduction and history of animal behaviour		
	1.2	Concepts of animal behaviour		
	1.3	Imprinting animals		
	1.4	Approaches and methods to study animal behavior and role of sense organs in behaviour		
2		**Types of animal behaviour**	15	25%
	2.1	Learning behaviour: types and neural mechanism		
	2.2	Aggressive behaviour: types, causes and hormonal control		
	2.3	Territorial behaviour: types, functions and methods		
	2.4	Parental care: Types and affecting factors		
3		**Behavioural ecology and social behaviour**	15	25%
	3.1	Orientation in animals: types, kinesis and taxes		
	3.2	Feeding strategies in animals		
	3.3	Types of communication: Auditory, Visual, Chemical and Tactile		
	3.4	Social organization in mammals		
4		**Physiology of animal behaviour**	15	25%
	4.1	Role of pheromones in animal behaviour		
	4.2	Role of hormones in animal behaviour		
	4.3	Biological clocks		
	4.4	Human ethology		

Suggested Readings:

1) Alcock J. 2013 Animal Behavior: An Evolutionary Approach, 10th edition (Sinauer Associates, Inc.)
2) Bolhuis J. J. and Giraldeau L. (eds) 2005 The behaviour of animals (Blackwell Pub.)
3) Breed and Moore 2011 Animal Behavior, 1st Edition (Academic Press)
4) Mathur R. 2008 Animal behaviour (Rastogi Pub.: India)
5) Manning A. and Dawkins M. S. 1997 An Introduction to Animal behaviour (4th edition)
6) Sherman P. W. and Alcock J. 1997 Exploring animal behaviour (Sinauer Asso. Inc. Pub.: Sunderland, Massachusetts)
7) Slater P. J. B. 1999 Essentials of Animal Behaviour (Cambridge Uni. Press)

Subject Code: MZOO402DSC **Semester: IV**

Subject Name: Animal Behavior **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Studying animal behavior will provide you with a deeper understanding of how animals interact with each other and their environment.
CO2	You'll learn about the biological and psychological mechanisms that influence behavior, including genetics, hormones, and learning.
CO3	Animal behavior is product of the computational and motor activity of specific circuits and is closely related with cognitive functions (e.g., learning, memory, decision-making) of the brain.
CO4	They help the animals get food for energy, make sure their young survive, or ensure that they, themselves, survive. Behaviors that help animals or their young survive, increase the animals' fitness.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**
Course Code	**MZOO403DSC**	**Semester**	**IV**
Toxicology and Environmental Biology			
Course type :	Discipline Specific Course	**Total Credit :**	4
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs) / **Practical** (hrs)		**Internal** (Marks)	**External** (Marks) / **Total** (Marks)
60	-------	30	70 / 100

Unit	Topic	Content	Hours	Weightage
1		**Introduction to toxicology**	15	25%
	1.1	Brief history of toxicology		
	1.2	Introduction and classification of toxic agents		
	1.3	Spectrum of undesired effects of toxicity		
	1.4	Characteristic of exposure of toxicant		
2		**Dose response relationship in toxicology**	15	25%
	2.1	Dose–Response Relationships: LD_{50}, LC_{50}, IC_{50}, IC_{90}, IC_{99}, EC_{50}, EC_{90} and EC_{99}		
	2.2	Evaluating the Dose–Response Relationship		
	2.3	Variation in toxic responses		
	2.4	Descriptive animal toxicity tests		
3		**Environmental pollution**	15	25%
	3.1	Air pollution		
	3.2	Water pollution		
	3.3	Soil pollution		
	3.4	Noise pollution		
4		**Global environmental change and environmental impact assessment**	15	25%
	4.1	Green house effect		
	4.2	Approaches to deal with global warming		
	4.3	Impact, prevention and mitigation of invasive species		
	4.4	Environmental impact assessment		

Suggested Readings:

1) Walker C H, Hopkin S P, Sibly R N and Peakall D B (Eds.) 2006. Principles of ecotoxicology- 3 rd edition, Taylor and Francis, NewYork, NY.
2) Landis W.G.and Yu M.H. 2003 Introduction to Environmental toxicology -3 rd edition, Lewis publishers, Florida.
3) Hodgson E. and Levi P. 2000. Text Book of Modern Toxicology, McGraw – Hill International edition. Singapore.
4) Agarwal A. and Gopal K. 2010 Principles of toxicology, ibdc publishers India.

Subject Code: MZOO403DSC **Semester: IV**

Subject Name: Toxicology and Environmental Biology **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Identifies simple observable features (e.g., shape, colour, texture, aroma) of leaves, trunk and bark of plants in immediate surroundings.
CO2	Toxicologists predict where chemicals will end up in the environment and in our bodies, analyze the toxic impact of chemicals and monitor exposure limits to keep us and our environment healthy.
CO3	Understand toxicology and associated terms. Learn about everyday toxic substances. Interpret a dose-response curve. Acquire information about biological variation.
CO4	Toxicology is the study of how natural or man-made poisons cause undesirable effects in living organisms.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc. Zoology**	
Course Code	**MZOO404DSC**	**Semester**	**I**	
Entomology				
Course type :	Discipline Specific Course	**Total Credit :**	4	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Introduction to entomology**	15	25%
	1.1	Introduction to entomology		
	1.2	General characters of insect		
	1.3	Classification of class insects (up to order)		
	1.4	External morphology of insect: Head, Thorax and Abdomen (Grasshopper)		
2		**Internal morphology of an insect (Grasshopper)**	15	25%
	2.1	Digestive system, circulatory system, respiratory system		
	2.2	Nervous system and sense organs		
	2.3	Reproductive system and excretory system		
	2.4	Different types of receptors and related organs		
3		**Physiology of an insect**	15	25%
	3.1	Metamorphosis and molting in insect		
	3.2	Gaseous exchange and thermoregulation in insect		
	3.3	Excretion and water regulation in insect		
	3.4	Communication in insect: light production, sound production and chemical communication		
4		**Applied entomology**	15	25%
	4.1	Insect pest to crop, pulses and vegetable and their control		
	4.2	Household pest and their control		
	4.3	Methods to control insect pest		

	4.4	Insect vectors and Integrated pest management		

References

1) Chapman R.F. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
2) David B.V. and Ananthkrishnan T. N. 2004. General and Applied Entomology. TataMcGraw Hill, New Delhi.
3) Duntson P. A. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
4) Mathur and Upadhyay A textbook of Entomology. Aman publication house, India.
5) Richards O. W. and Davies R. G. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman & Hall, London.
6) Saxena R.C. and Srivastava R. C. 2007. Entomology: At a Glance. Agrotech Publ. Academy, Jodhpur.

Subject Code: MZOO404DSC **Semester: IV**
Subject Name: Entomology **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Develop the ability to design and perform a scientific study on insects, and to analyze results
CO2	Develop an understanding of the distributions and abundances of organisms including insects, and their interactions with each other and the environment.
CO3	Attain a solid foundation in insect biology, including general entomology, basic systematics, morphology, physiology, and biodiversity
CO4	Understand evolution and biodiversity generation through macro- and micro-evolutionary processes, including how these processes have formed and diversified insects
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR

Programme Code	MZOO	Programme Name	M.sc Zoology
Course Code	MZOO406SE	Semester	IV

Wildlife Biology- 4

Course type :	Subject Elective	Total Credit :	02

Teaching time (hours)		Examination Marking scheme		
Theory (hrs)	Practical (hrs)	Internal (Marks)	External (Marks)	Total (Marks)
30	-------	15	35	50

Unit	Topic	Content	Hours	Weightage
1		**Important legislations for wildlife**		
	1.1	Indian Wildlife Protection Act (1972)	15	50%
	1.2	Forest Act (1927)		
	1.3	National Biodiversity Act (2002)		
	1.4	Importance of law and regulations in wildlife conservation		
2		**Wildlife conservation at global scale**		
	2.1	IUCN as a global conservation organization	15	50%
	2.2	CITIES		
	2.3	TRAFFIC		
	2.4	Wildlife crime control: case studies		

References

1) Sinclair A. R., Fryxell J M and Caughly G. (2006) Wildlife Ecology, Conservation and Management. Blackwell Publishing, U.S.A.
2) Gopal R. (1992) Fundamentals of Wildlife Management. Justice Home, Allahabad, India.
3) Jairajpuri M. S. (1990) Collection and preservation of animals. Zoological Survey of India.
4) Magguran, A.E. (1996). Ecological diversity and its measurements. Princeton University.
5) Gadgil, M. (2002) A methodology mannual for scientific inventorying, monitoring and conservation of Biodiversity
6) Hickman C. P., et al. 2006 Integrated principals of Zoology, McGraw Hill Higher Education. 931pp. 14th edition.

Subject Code: MZOO406SE **Semester: IV**
Subject Name: Wildlife Biology - 4 **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials.
CO2	Students will learn about certain species' roles in an ecosystem.
CO3	Students will discover that life can be found almost everywhere on earth.
CO4	Students will be able to identify species, characteristics, habitat requirements and life cycles of birds, fish and/or mammalian wildlife species.
CO5	

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	-	-	-	-	**2**	**2**	-		
CO2	**1**	**2**	**2**	-	-	-	-	**1**	**2**	-		
CO3	**2**	**3**	**2**	-	-	-	-	**1**	**2**	-		
CO4	**2**	**2**	**1**	-	-	-	-	**2**	**1**	-		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													-	**2**
CO2													-	**2**
CO3													-	**1**
CO4													-	**2**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MZOO**	**Programme Name**	**M.Sc Zoology**	
Course Code	**MZOO401PRA**	**Semester**	**IV**	
Histology, Histochemistry and Parasitology, Animal Behaviour				
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Histology, Histochemistry and Parasitology

1) Study of different types of microtomes.
2) To study histological structure of different types of epithelial tissue using permanent slides.
3) To study histological structure of different types of muscle tissue using permanent slides.
4) To study histological structure of bone and cartilage using permanent slides.
5) Study of parasitic protozoan causing disease in humans.
6) Study of parasitic platyhelmithes causing diseases in humans.
7) Study of parasitic nematods causing diseases in humans.
8) Study of parasitic mites and ticks.

Animal Behaviour

9) Study of mudballing behavior of burrowing crab.
10) To study food preference in *Tribolium castaneum.*
11) To study the different types of receptors in *Tribolium castaneum.*
12) To study location of receptors by antennalectomy in *Tribolium castaneum.*
13) To study the effect of water temperature and pH on breathing rate of fish.

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MZOO**	**Programme Name**	**M.Sc Zoology**
Course Code	**MZOO402PRA**	**Semester**	**IV**
Toxicology and Environmental Biology, Entomology			
Course type :	Practical	**Total Credit :**	03
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------	90	------	75	75

LIST OF EXPERIMENTS

Toxicology and Environmental Biology

1) To study the toxic effect of irritant on breathing rate of fish.
2) Comparative analysis of water samples collected from polluted and non polluted water bodies.
3) Comparative analysis of soil samples collected from polluted and non polluted water bodies.
4) To study the effect of neem tree leaf extract on mosquito larvae
5) Study of effect of common carcinogens and teratogens on human body using charts and pictures.

Entomology

6) Study of classification of class insecta up to orders using museum specimens.
7) Mounting of mouth parts of mosquito and housefly.
8) Study of modification of antennae in different insects.
9) Study of modification of legs in different insects.
10) Study of different systems of insect using charts/pictures.
11) Study of insect pest of crop, pulses and vegetable and their control.
12) Prepare a report on insect diversity of selected study site.