



SOPHIA COLLEGE, (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Programme: Zoology

Programme Code: SBSZOO

S.Y.B.Sc. Zoology

(Choice Based Credit System with effect from the year 2018-19)

Programme Outline: SYBSc Zoology (SEMESTER III)

Course Code	Unit No	Name of the Unit	Credits
		FUNDAMENTALS OF GENETICS, CHROMOSOMES AND HEREDITY, NUCLEIC ACIDS	2
US.ZOO.3.01	1	Fundamentals of Genetics	
	2	Chromosomes & Heredity	
	3	Nucleic Acids	
US.ZOO.3.02		STUDY OF NUTRITION, EXCRETION, RESPIRATION, CIRCULATION, CONTROL AND COORDINATION, LOCOMOTION AND REPRODUCTION	2
	1	Nutrition & Excretion	
	2	Respiration & Circulation	
	3	Control and Coordination of Life Processes, Locomotion & Reproduction	
US.ZOO.3.03		ETHOLOGY, PARASITOLOGY, ECONOMIC	2
	1	Ethology	
	2	Parasitology	
	3	Economic Zoology	
US.ZOO.P3		Practical I	3
		Practical II	
		Practical III	

Programme Outline: SYBSc Zoology (SEMESTER IV)

Course Code	Unit No	Name of the Unit	Credits
US.ZOO.4.01		ORIGIN AND EVOLUTION OF LIFE, POPULATION GENETICS AND EVOLUTION, SCIENTIFIC ATTITUDE, METHODOLOGY, SCIENTIFIC WRITING AND ETHICS IN SCIENTIFIC RESEARCH	2
	1	Origin and Evolution of Life	
	2	Population Genetics and Evolution	
	3	Scientific Attitude, Methodology, Scientific Writing and Ethics in Scientific Research	
US.ZOO.4.02		CELL BIOLOGY, ENDOMEMBRANE SYSTEM AND BIOMOLECULES	2
	1	Cell Biology	
	2	Endomembrane System	
	3	Biomolecules	
US.ZOO.4.03		COMPARATIVE EMBRYOLOGY, ASPECTS OF HUMAN REPRODUCTION, POLLUTION AND ITS EFFECT ON ORGANISMS	2
	1	Comparative Embryology	
	2	Aspects of Human Reproduction	
	3	Pollution and its Effect on Organisms	
US.ZOOP.4		Practical I	3
		Practical II	
		Practical III	

Preamble:

This syllabus of Zoology Program offered by Sophia College for Women; Mumbai has been designed under the autonomous status conferred in the academic year 2018-2019.

The syllabus tries to encompass fundamental as well as applied areas such as taxonomy, developmental biology, genetics, physiology, evolution, ecology, biochemistry, as well as applied biology disciplines like biotechnology, bioinformatics, forensic science, and many others. The syllabus is planned such that the learners who are beginning their academic journey opting for the subject of Zoology will be equipped with not only with the basic knowledge of the animal world but also the recent trends in the subject.

Learning of the subject would involve various innovative pedagogies such as experiential learning, problem-based learning, collaborative learning in addition to the traditional mode of learning. Besides sensitizing the learners towards environment and sustainability, the subject also offers career opportunities in a variety of fields such as conservation, research, education, and animal management.

PROGRAMME OBJECTIVES

PO 1	To provide a holistic knowledge about animal biology such as taxonomy, comparative anatomy and physiology, behaviour, ecology and evolution.
PO 2	To develop experimental and research-oriented skills for future career in academia
PO 3	To gain field-based knowledge through experiential learning
PO 4	To get acquainted with the applied areas of zoology to promote employability and entrepreneurship
PO 5	To encourage understanding about the importance of biodiversity conservation, the threats facing ecosystems and the conservation measures used to preserve wildlife.

PROGRAMME SPECIFIC OUTCOMES

PSO 1	Apply the field-based and the in-class knowledge of animal biology to identify and classify the animals in their natural habitat upto class level
PSO 2	Identify the various types of animal behaviour, and animal interactions with the

	ecosystem
PSO 3	Conduct basic research that involves application of critical thinking and experimental skills
PSO 4	Get career opportunities in a variety of fields such as conservation, research, education, and animal management

SEMESTER III

NAME OF THE COURSE	SYSTEMATIC CLASSIFICATION OF INVERTEBRATES AND ECOLOGY	
CLASS	SYBSC ZOOLOGY	
COURSE CODE	US.ZOO.3.01	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	25	75
PASSING MARKS	10	30

COURSE OBJECTIVES:

CO 1.	To develop conceptual clarity of Mendelian principles of inheritance and other forms and pattern of inheritance
CO 2.	To familiarize the learners with the structure, types and classification of chromosomes.
CO 3.	To introduce the learner the structure of nucleic acids and the concept of central dogma of molecular biology.

COURSE LEARNING OUTCOMES:

CLO 1.	Learners will be able to apply the principles of inheritance to study heredity
CLO 2.	Learners will be able to understand the structure of a chromosome and distinguish between various types of chromosomes
CLO 3.	Learner will understand the importance of nucleic acids as genetic material and their role in protein synthesis

UNIT 1	Fundamentals of Genetics (15 LECTURES)
1.1	Introduction to Genetics 1.1.1: Definition, Scope and Importance of Genetics 1.1.2: Classical and Modern concept of Gene (Cistron, Muton, Recon) 1.1.3: Brief explanation of the following terms: Allele, Wild type and Mutant alleles, Locus, Dominant and Recessive traits, Homozygous and Heterozygous, Genotype and Phenotype, Genome
1.2	Mendelian Genetics 1.2.1: Mendelian Genetics: Monohybrid & Dihybrid Cross, Test Cross, Back Cross, Mendel's Laws of Inheritance, Mendelian Traits in Man. 1.2.2: Exceptions to Mendelian inheritance: Incomplete dominance, Co- dominance, Lethal Genes, Epistasis - Recessive, Double recessive, Dominant and Double dominant. 1.2.3: Pedigree Analysis-Autosomal dominant and recessive, X- linked dominant, and recessive.
1.3	Multiple Alleles and Multiple Genes 1.3.1: Concept of Multiple Alleles, Coat colour in rabbit, ABO and Rh blood group system 1.3.2: Polygenic inheritance with reference to skin colour and eye colour in humans.
1.4	Linkage and Crossing Over 1.4.1: Morgan's data on linkage in <i>Drosophila</i> 1.4.2: Crossing over: Process of crossing over , cytological basis of crossing over, types of crossing over
UNIT 2	Chromosomes and Heredity (15 LECTURES)
2.1	Chromosomes 2.1.1: Types of chromosomes– Autosomes and Sex chromosomes 2.1.2: Chromosome structure, Heterochromatin, Euchromatin 2.1.3: Classification based on the position of centromere 2.1.4: Giant chromosomes- Endomitosis, Polytene and Lampbrush chromosomes and significance of Balbiani rings.
2.2	Sex- determination 2.2.1: Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZO, ZZ-ZW. 2.2.2: Sex determination in <i>Drosophila</i> - Genic balance theory, intersex, gynandromorphs. 2.2.3: Sex determination in honey bees - Haplodiploidy, 2.2.4: Hormonal influence on sex determination-Freemartin and sex reversal 2.2.5: Role of environmental factors- Bonellia and Crocodile 2.2.6: Barr bodies and Lyon hypothesis
2.3	Sex linked, sex influenced and sex-limited inheritance. 2.3.1: X-Linked: Colourblindness, Haemophilia 2.3.2: Y-linked: Hypertrichosis 2.3.3: Sex-influenced inheritance 2.3.4: Sex limited inheritance
UNIT 3	Nucleic acids (15 LECTURES)

3.1	Genetic material 3.1.1: Griffith's transformation experiments, Avery-Macleod and McCarty, Hershey Chase experiment of Bacteriophage infection 3.1.2: Chemical composition and structure of nucleic acids 3.1.3: Double helix nature of DNA, Solenoid model of DNA 3.1.4: Types of DNA – A, B, Z & H forms 3.1.5: DNA in Prokaryotes -Chromosomal and Plasmid 3.1.6: Extra nuclear DNA -Mitochondria and Chloroplast 3.1.7: RNA as a genetic material in viruses 3.1.8: Types of RNA: Structure and function
3.2	Flow of genetic information in a eukaryotic cell 3.2.1: DNA Replication 3.2.2: Transcription of mRNA 3.2.3: Translation 3.2.4: Genetic code
3.3	Gene expression and regulation 3.3.1: One gene-one enzyme hypothesis /one polypeptide hypothesis 3.3.2: Concept of Operon 3.3.3: Lac Operon

REFERENCES:

1. Principles of Genetics. Gardner, E. J., Simmons, M.J and Snustad, D.P. John Wiley and Sons
2. Genetics- A Molecular Approach. Russell, P. J Benjamin Cummings
3. Genetics: Analysis of Genes and Genomes. Daniel L., Hartl, Elizabeth W. Jones Jones & Bartlett Publishers
4. Introduction to Genetic Analysis. Griffiths, A. J. F., Wessler. S.R., Lewontin, R.C. and Carroll, S. B. W. H. Freeman and Co
5. Cell Biology Genetics, Molecular Biology Evolution and Ecology Verma P. S. and Agrawal P.K., 9th edition, S. Chand Publication, New Delhi
6. Genetics- Weaver, Hedrick, third edition, McGraw Hill Education
7. Genetics A Mendelian approach Peter J. Russel, Pearson Benjamin Cummings
8. Genetics A conceptual approach, Benjamin A. Pierce, Southwestern University, W.H. Freeman and company, New York
9. Genetics, Third Edition, Monroe W. Strickberger
10. Genetics from gene to genome, third edition, Leeland H. Hartwell, Leeroy Hood, Michael 7. L. Goldberg, Ann E. Reynolds, Lee M. Silver, McGraw Hill Education

NAME OF THE COURSE	NUTRITION AND EXCRETION, RESPIRATION AND CIRCULATION, CONTROL AND COORDINATION OF LIFE PROCESSES, LOCOMOTION AND REPRODUCTION
CLASS	SYBSC ZOOLOGY

COURSE CODE	US.ZOO.3.02	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	25	75
PASSING MARKS	10	30

COURSE OBJECTIVES:

CO 1.	To introduce the concepts of physiology of nutrition, excretion and osmoregulation.
CO 2.	To introduce the concepts of physiology of respiration and circulation
CO 3.	To introduce the concepts of physiology of control and coordination and locomotion and reproduction.

COURSE LEARNING OUTCOMES:

CLO 1.	Learner would be able to correlate the nutritional, excretory and osmoregulatory structures as per the habits and habitat of various organisms
CLO 2.	Learner would be able to evaluate the increasing complexity of respiratory and circulatory physiology in evolutionary hierarchy.
CLO 3.	Learner would be able to list the events involved in the process of control and coordination by nervous and endocrine regulation.

UNIT 1	Nutrition and Excretion (15 LECTURES)
1.1	Comparative study of nutritional apparatus (structure and function): Amoeba, Hydra, Cockroach, Amphioxus, Pigeon, Ruminants.
1.2	Physiology of digestion in man.

1.3	Comparative study of excretory and osmoregulatory structures and functions. a) Amoeba - Contractile vacuoles b) Planaria - Flame cells c) Cockroach - Malphigian tubules
1.4	Categorization of animals based on principle nitrogenous excretory products
1.5	Structure of kidney, uriniferous tubule and physiology of urine formation in man
UNIT 2	Respiration and Circulation (15 LECTURES)
2.1	Comparative study of respiratory organs (structure and function): Earthworm, Spider, Any bony fish (Rohu/ <i>Anabas/Clarius</i>), Frog and Pigeon.
2.2	Structure of lungs and physiology of respiration in man
2.3	Comparative study of circulation: (a) Open and Closed type, (b) Single and Double type.
2.4	Types of circulating fluids- Water, Coelomic fluid, Haemolymph, Lymph and Composition of blood
2.5	Comparative study of hearts (structure and function): Earthworm, Cockroach, Shark, Frog, Crocodile and Pigeon.
2.6	Structure and mechanism of working of heart in man.
UNIT 3	Control and Coordination, Locomotion and Reproduction (15 LECTURES)
3.1	Control and coordination 3.1.1: Irritability in Paramecium, nerve net in Hydra, nerve ring and nerve cord in earthworm. 3.1.2: Types of neurons based on the structure and function. 3.1.3: Conduction of nerve impulse: Resting potential, Action potential and Refractory period 3.1.4: Synaptic transmission
3.2	Movement and Locomotion 3.2.1: Locomotory organs- structure and functions of: a. Pseudopodia in Amoeba (Sol- Gel theory), Cilia in Paramecium b. Wings and legs in cockroach c. Tube feet in starfish d. Fins of fish 3.2.2: Structure of striated muscle fibre in human and sliding filament theory
3.3	Reproduction 3.3.1: Asexual Reproduction- Fission, Fragmentation, Gemmule formation and Budding 3.3.2: Sexual reproduction Gametogenesis b. Structure of male and female gametes in human c. Types of fertilization d. Oviparity, Viviparity, Ovo-viviparity

REFERENCES:

1. Vertebrate Zoology Volume I- Jordan and Verm , S. Chand and Co.
2. Invertebrate Zoology Volume II- Jordan and Verma , S. Chand and Co.
3. Invertebrate Zoology- Majupuria T. C., NaginS.and Co.
4. Chordate Zoology- Dhami P. S. and Dhami J. K., R. Chand and Co.
5. Invertebrate Zoology- Dhami P. S. and Dhami 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.

NAME OF THE COURSE	ETHOLOGY , PARASITOLOGY, ECONOMIC ZOOLOGY	
CLASS	SYBSC ZOOLOGY	
COURSE CODE	US.ZOO.3.03	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	25	75
PASSING MARKS	10	30

COURSE OBJECTIVES:

CO 1.	To equip learners with a sound knowledge of how animals interact with one another and their environment.
CO 2.	To acquaint the learner with the concepts of parasitism and its relationship in the environment.
CO 3.	To disseminate information on economic aspects of animals like apiculture, vermiculture and dairy science for encouraging towards self-employment

COURSE LEARNING OUTCOMES:

CLO 1.	Learner will be able to relate different types of animal behaviour and their role in biological adaptations.
CLO 2.	Learners will be able to describe the life cycle of specific parasites, the symptoms of the disease and its treatment.
CLO 3.	Learner will gain fundamental knowledge on animal husbandry which may be pursued in future for entrepreneurship as a career.

UNIT 1	Ethology (15 LECTURES)
1.1	Introduction to Ethology: 1.1.1: Definition, History and Scope of Ethology 1.1.2: Animal behaviour : Innate and Learned behaviour 1.1.3: Types of learning: Habituation, Imprinting and Types of imprinting - Filial and sexual, Classical conditioning 1.1.4: Instrumental learning and insight learning.
1.2	Aspects of animal behaviour: 1.2.1: Communication in bees and ants 1.2.2: Mimicry and colourations 1.2.3: Displacement activities, Ritualization 1.2.4: Migration in fish, schooling behaviour 1.2.5: Habitat selection, territorial behaviour.
1.3	Social behaviour: 1.3.1: Social behaviour in primates-Hanuman langur 1.3.2: Elements of socio-biology: Altruism and Kinship
UNIT 2	Parasitology (15 LECTURES)
2.1	Introduction to Parasitology and Types of Parasites 2.1.1: Definitions: Parasitism, Host, Parasite, Vector-biological and mechanical 2.1.2: Types of parasite: Ectoparasite, Endoparasite and their subtypes 2.1.3: Parasitic adaptations in Ectoparasites and Endoparasites 2.1.4: Types of host: Intermediate and definitive, reservoir
2.2	Host-parasite relationship and host specificity Different types of host – parasite relationships, structural specificity, physiological specificity and ecological specificity
2.3	Life cycle, pathogenicity, control measures and treatment 2.3.1: <i>Entamoeba histolytica</i> ,

	<p>2.3.2:<i>Fasciola hepatica</i>, 2.3.3:<i>Taenia solium</i>, 2.3.4:<i>Wuchereria bancrofti</i></p>
2.4	<p>Morphology, life cycle, pathogenicity, control measures and treatment 2.4.1: Head louse (<i>Pediculus humanus capittis</i>) 2.4.2: Mite (<i>Sarcoptes scabiei</i>) 2.4.3: Bed bug (<i>Cimex lectularis</i>)</p>
2.5	<p>Parasitological significance Zoonosis- Bird flu, Anthrax, Rabies and Toxoplasmosis</p>
UNIT 3	Economic Zoology (15 LECTURES)
3.1	<p>Apiculture 3.1.1: Methods of bee keeping and management a. Introduction to different species of honey bees used in apiculture. b. Selection of flora and bees for apiculture. c. Advantages and disadvantages of traditional and modern methods of apiculture. d. Pests and Bee enemies- Wax moth, wasp, black ants, bee-eaters, king crow and disease control 3.1.2: Economic importance a. Honey- Production, chemical composition and economic importance b. Bee wax- Composition and economic importance. c. Role of honey bee in pollination.</p>
3.2	<p>Vermiculture: 3.2.1: Rearing methods, management and economic importance a. Introduction to different species of earthworms used in vermiculture. b. Methods of vermiculture. c. Maintenance and harvesting d. Economic importance: advantages of vermiculture, demand for earthworms; market for vermicompost and scope for entrepreneurship.</p>
3.3	<p>Dairy science 3.3.1: Dairy development in India Role of dairy development in rural economy, employment opportunities 3.3.2: Dairy Processing Filtration, cooling, chilling, clarification, pasteurization, freezing 3.3.3: Milk and milk products a. Composition of milk b. Types of milk:Buffalo milk, Cow milk (A1 and A2), Whole milk and toned milk c.Milk products</p>

REFERENCES:

1. Animal Behaviour: Psychobiology, Ethology and Evolution by David McFarland, Publisher : Longman; 3rd edition, 1999
2. Animal Behaviour. by Mohan P. Arora. Edition, 2. Publisher, Himalaya Publishing House, 1995.
3. An Introduction to Animal Behaviour by Aubrey Manning and Marian Stamp Dawkins. Sixth Edition. Cambridge University Press, 2015
4. Bee and Bee Keeping- Roger A. Morse, Cornell University Press London
5. Parasitology- Chatterjee K. D., Chatterjee Medical Publishers.
6. Textbook of Medical Parasitology-.C.K Jayaram Paniker, Jaypee Brothers.
7. Economic Zoology- Shukla G.S. & Upadhyay V. B., Rastogi Publications.
8. A handbook on Economic Zoology, S. Chand & Co.
9. Candler, W., & Kumar, N. (1998). India: The dairy revolution: The impact of dairy development in India and the World Bank's contribution. World Bank Publications.
10. Milk and dairy products in human nutrition: production, composition and health. John Wiley & Sons, Park, Y. W., & Haenlein, G. F. (Eds.). (2013).
11. Dairy development in India: An appraisal of challenges and achievements. Concept Publishing Company, Venkatasubramanian, V., Singh, A. K., & Rao, S. V. N. (2003).

PRACTICAL COURSE US.ZOOP.3
PRACTICAL I

1. Extraction and detection of DNA
2. Extraction and detection of RNA
3. Mounting of Barr bodies
4. Study of polytene chromosome
5. Study of mitosis- temporary squash preparation of Onion root tip
6. Detection of blood groups and Rh factor
7. Problems in Genetics
8. a) Monohybrid/ Dihybrid Cross, b) X- linked inheritance, c) Multiple Alleles
9. Chromosome morphology: (photograph to be provided)
10. Pedigree analysis
11. Problems based on molecular biology

PRACTICAL II

1. Urine analysis—Normal and Abnormal constituents
2. Detection of ammonia excreted by fish from aquarium water
3. Detection of uric acid from excreta of birds
4. Study of striated and non-striated muscle fibre
5. Study of nutritional apparatus (Amoeba, Hydra, Earthworm, Pigeon and Ruminant stomach)
6. Study of respiratory structures:
 - a. Gills of bony fish and cartilaginous fish
 - b. Lungs of frog
 - c. Lungs of mammal
 - d. Accessory respiratory structure in *Anabas/ Clarius*
 - e. Air sacs of Pigeon

7. Study of locomotory organs (Amoeba, Bivalve, Cockroach, Starfish, Fish, and Bird)
8. Study of different types of heart (Cockroach, Shark, Frog, Garden lizard, Crocodile and Mammal)
9. Study of permanent slides on Reproduction: (a) Sponge gemmules
10. (b) Hydra budding (c) T.S. of mammalian testis (d) T.S. of mammalian ovary

PRACTICAL III

- 1.Extraction of casein from milk and its qualitative estimation
- 2.Preparation of paneer from given milk sample
- 3.Measurement of density of milk using different samples by Lactometer
- 4.Study of Honey Bee:
 - a) Life Cycle of Honey Bee and Bee Hive
 - b) Mouthparts of Honey Bee
 - c) Legs of Honey Bee
- 5.Sting Apparatus of Honey Bee
- 6.Study of ethological aspects:
 - a) Warning colouration
 - b) Animal instinct
 - c)Imprinting
 - d)Communication in animals: Chemical signals and Sound signals
- 7.Displacement activities in animals: Courtship and mating behaviour in animals and Ritualization
- 8.Study of Protozoan parasite:

a) *Trypanosoma gambiense*

b) *Giardia intestinalis*

9. Study of Helminth parasite:

a) *Ancylostoma duodenale*

b) *Dracunculus medinensis*

10. Parasitic adaptations: Scolex and mature proglottids of Tapeworm

11. Study of Ectoparasite:

a) Leech b) Tick c) Mite

12. Project- Suggested topics on economic zoology (e.g., Apiculture/ Sericulture/ Lac culture / Vermicompost technique / Construction of artificial beehives / Animal husbandry/ Aquaculture/ Any other)

N.B. The practicals could be conducted by using specimens authorised by the wildlife and such other regulating authorities. However, adhering to the directions as given in the UGC Circular F14-4/2006 (CPP-II), the practicals will be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies.

ASSESSMENT DETAILS:(This will be same for all the theory papers)

Maximum Marks allotted for each theory course per semester: 100 marks

- (a) Internal assessment of total of twenty-five (25) marks per course per semester shall be conducted as: out of 20 marks based on the test / project and out of 5 marks based on the active participation in the class.
- (b) Semester End Examination – External Assessment (75 marks)

Practical Assessment (for papers with practicals)

Maximum Marks allotted for the entire practical course per semester: 150 marks which will be distributed into the following two examination sessions and conducted as per the given question paper pattern:

- a) Practical I examination of fifty (50) marks shall be conducted at the end of every semester.
 - b) Practical II examination of fifty (50) marks shall be conducted at the end of every semester.
 - c) Practical III examination of fifty (50) marks shall be conducted at the end of every semester.
- The duration of the practical exam will be two and a half hour.
 - The students are allowed to write the paper if the attendance for practicals is more than 75%
 - To appear in the practical exam, students must bring a properly certified journal.

PAPER PATTERN OF INTERNAL ASSESSMENT US.ZOO.3.01, US.ZOO.3.02, US.ZOO.3.03

**All Questions are compulsory
Figures to the right indicate full marks**

Time: 50 minutes

Total marks: 20

Q.1.	*Objective type questions	05 marks
Q.2.	Answer in one sentence OR Define the following	05 marks
Q.3.	Answer any two out of three (05 marks each)	10 marks

**PAPER PATTERN OF THEORY EXTERNAL ASSESSMENT
US.ZOO.3.01 , US.ZOO.3.02, US.ZOO.3.03**

**All Questions are compulsory
Figures to the right indicate full marks**

Time: 2.5 hours

Total marks: 75

Q.1.	Based on UNIT 1 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.2.	Based on UNIT 2 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.3.	Based on UNIT 3 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.4.	Based on all three units – two from each unit Answer any three out of six (5 marks each)	15 marks

**PAPER PATTERN OF PRACTICAL EXAMINATION
US. ZOOP.3**

PRACTICAL I EXAMINATION

Duration : 2 hrs 30 min

Marks: 50

Major Question

(15 marks)

Q1. Extraction and detection of DNA

OR

Q1. Extraction and detection of RNA

Minor Question

(07 marks)

Q2. Mounting of Barr bodies / Polytene chromosomes

OR

Q2. Study of mitosis-Temporary squash preparation of Onion root tip

OR

Q2. Detection of blood groups and Rh factor

Q3. Problems based on Genetics and Molecular biology

(Transcription /Genetic code) (01 problem each)

(10 marks)

Q4. Identification

(08 marks)

A. Chromosome morphology

B. Pedigree analysis

Q5. Viva

(05 marks)

Q.6 Journal

(05 marks)

PRACTICAL II EXAMINATION

Duration : 2 hrs 30 min

Marks: 50

Major Question

(15 marks)

Q1. Urine analysis—Normal and abnormal constituents

Minor Question

(10 marks)

Q2. Detection of ammonia excreted by fish in aquarium water

OR

Q2. Detection of uric acid from excreta of Birds

OR

Q2. Mounting of striated and non-striated muscle fibre

Q3. Identification

(15 marks)

a. Nutritional apparatus

b. Respiratory structures

c. Locomotory organs

d. Study of hearts

e. Permanent slides on reproduction

Q4. Viva

(05 marks)

Q5. Journal

(05 marks)

PRACTICAL III EXAMINATION

Duration : 2 hrs 30 min

Marks : 50

Major Question

(12 marks)

Q1. Extraction of casein from milk and its qualitative detection

OR

Q1. Preparation of paneer from the given milk sample.

OR

Q1. Measurement of density of different samples of milk by lactometer

Minor Question (Sketch and label)

(08 marks)

Q2. Life cycle of honey bee

OR

Q2. Mouthparts of honey bee

OR

Q2. Legs of honey bee

OR

Q2. Sting apparatus of honey bee

Q3. Identify and describe as per instructions

(15 marks)

a. Ethology

b. Protozoan parasite

c. Helminth parasite

d. Ectoparasite

e. Parasitic adaptation

Q4. a) Project submission

(06 marks)

Q5. Viva based on project

(04 marks)

Q5. Journal

(05 marks)

SEMESTER IV

NAME OF THE COURSE	ORIGIN AND EVOLUTION OF LIFE, POPULATION GENETICS AND EVOLUTION, SCIENTIFIC ATTITUDE, METHODOLOGY, SCIENTIFIC WRITING AND ETHICS IN SCIENTIFIC RESEARCH	
CLASS	SYBSC ZOOLOGY	
COURSE CODE	US.ZOO.4.01	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	25	75
PASSING MARKS	10	30

COURSE OBJECTIVES:

CO 1.	To impart scientific knowledge about how life originated on our planet
CO 2.	To develop an understanding of genetic variability within a population and learn as to how the change in the gene pool leads to evolution of species
CO 3.	To inculcate scientific temperament in the learner

COURSE LEARNING OUTCOMES:

CLO 1.	Learners will analyse and critically view the different theories of evolution.
CLO 2.	Learners will be able to distinguish between microevolution, macroevolution and megaevolution
CLO 3.	The learners will apply the concepts of research methodology through simple exercises

UNIT 1	Origin and Evolution of Life (15 LECTURES)
1.1	Introduction 1.1.1: Origin of the Universe 1.1.2: Chemical evolution - Miller-Urey experiment, Haldane and Oparin theory 1.1.3: Origin of life 1.1.4: Origin of eukaryotic cell
1.2	Evidences in favour of organic evolution Evidences from geographical distribution, palaeontology, anatomy, embryology, physiology and genetics
1.3	Theories of organic evolution 1.3.1: Theory of Lamarck 1.3.2: Theory of Darwin and Neo- Darwinism 1.3.3: Mutation Theory 1.3.4: Modern synthetic theory 1.3.5: Weismann's Germplasm theory
UNIT 2	Population Genetics and Evolution (15 LECTURES)
2.1	Introduction to Population genetics Brief explanation of the following terms: Population, Gene pool, Allele frequency, Genotype frequency, Phenotype frequency, Microevolution
2.2	Population genetics 2.2.1: Hardy- Weinberg Law 2.2.2: Factors that disrupt Hardy Weinberg equilibrium: Mutation, Migration (gene flow), Non-random mating (inbreeding, inbreeding depression, assortative mating(positive and negative), disassortative mating, Genetic drift (sampling error, fixation, bottleneck effect and founder effect) 2.2.3: Natural Selection: Patterns of Natural Selection-Stabilizing selection, Directional selection (examples: peppered moth, antibiotic resistance in bacteria, pesticide resistance) and Disruptive selection
2.3	Evolutionary genetics 2.3.1: 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) 2.3.2: Nature of genetic variations: Genetic polymorphism, Balanced polymorphism, Mechanisms that preserve balanced polymorphism-Heterozygote advantage and frequency dependent selection, 2.3.2: Neutral variations 2.3.3: Geographic variation (Cline) 2.3.4: Species concept: Biological species concept and evolutionary species concept 2.3.5: Speciation and Isolating mechanisms:Definition and modes of speciation (allopatric, sympatric, parapatric and peripatric) 2.3.6: Geographical isolation 2.3.7: Reproductive isolation and its isolating mechanisms (prezygotic and postzygotic)

2.4	<p>Macroevolution and megaevolution:</p> <p>2.4.1: Concept and Patterns of macroevolution: stasis, preadaptation /exaptation, mass extinctions, adaptive radiation and coevolution</p> <p>2.4.2: Megaevolution</p>
UNIT 3	Scientific Attitude Methodology, Scientific Writing and Ethics in Scientific Research (15 LECTURES)
3.1	<p>Process of science:</p> <p>3.1.1: A dynamic approach to investigation: The Scientific method, Deductive reasoning and inductive reasoning, Critical thinking, Role of chance in scientific discovery (serendipity)</p> <p>3.1.2: Scientific research: Definition, difference between method and methodology, characteristics, types</p> <p>3.1.3: 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</p> <p>3.1.4: Dissemination of data: Reporting results to scientific community (publication in peer-reviewed journals, thesis, dissertation, reports, oral presentation, poster presentation)</p> <p>3.1.15: Application of knowledge: Basic research, Applied and Translational research</p>
3.2	<p>Scientific writing:</p> <p>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>
3.3	<p>Writing a review paper</p> <p>3.3.1: Structure and components of review paper</p> <p>3.3.2: Report writing and types of report</p> <p>3.3.3: Computer application: Plotting of graphs, Statistical analysis of data.</p> <p>3.3.4: Internet and its application in research- Literature survey, online submission of manuscript for publication</p>
3.4	<p>Ethics</p> <p>3.4.1: Ethics in animal research: The ethical and sensitive care and use of animals in research, teaching and testing, approval from Dissection Monitoring Committee (DMC)</p> <p>3.4.2: Ethics in clinical research: Approval from clinical research ethics committee or/and informed consent</p>
3.5	Plagiarism

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2. Evolution - Strickberger, CBS publication

3. Evolution- P. S. Verma and Agarwal, Population Genetics by Matthew B. Hamilton. First edition. 2009. John Wiley & Sons Ltd. UK
4. Principles of Population Genetics by Daniel L. Hartel and Andrew G. Clark. 3rd Edition. 1997. Sinauer Associates Inc. Sunderland, Massachusetts.
5. Research Methodology, Methods and Techniques- by C.R. Kothari, Wiley Eastern Ltd. Mumbai
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NAME OF THE COURSE	CELL BIOLOGY, ENDOMEMBRANE SYSTEM AND BIOMOLECULES	
CLASS	FYBSC ZOOLOGY	
COURSE CODE	US.ZOO.4.02	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	25	75
PASSING MARKS	10	30

COURSE OBJECTIVES:

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

COURSE LEARNING OUTCOMES:

CLO 1.	Learner would acquire insight into the composition of the transport mechanisms adopted by the cell and its organelles for its maintenance and composition of cell
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CLO 2.	Learner will understand the interlinking of endomembrane system for functioning of cell
CLO 3.	The learner will be able to describe the various biomolecules and their clinical significance.

UNIT 1	Cell Biology (15 LECTURES)
1.1	Introduction to cell biology <ul style="list-style-type: none"> ● Definition and scope ● Cell theory Generalized prokaryotic, eukaryotic cell: size, shape and structure
1.2	Nucleus <ul style="list-style-type: none"> ● Size, shape, number and position ● Structure and functions of interphase nucleus ● Ultrastructure of nuclear membrane and pore complex ● Nucleolus: general organization, chemical composition & functions ● Nuclear sap/ nuclear matrix Nucleocytoplasmic interactions
1.3	Plasma membrane <ul style="list-style-type: none"> ● Fluid Mosaic Model ● Junctional complexes ● Membrane receptors Modifications: Microvilli and Desmosomes
1.4	Transport across membrane <ul style="list-style-type: none"> ● Diffusion and Osmosis ● Transport: Passive and Active ● Endocytosis and Exocytosis
1.5	Cytoskeletal structures <ul style="list-style-type: none"> ● Microtubules: Composition and functions ● Microfilaments: Composition and functions
UNIT 2	Endomembrane System (15 LECTURES)
2.1	Endoplasmic reticulum (ER): General morphology of endomembrane system, ultrastructure, types of ER and biogenesis of ER Functions of Rough Endoplasmic Reticulum(RER) and Smooth Endoplasmic Reticulum(SER)
2.2	Golgi complex: Ultrastructure of Golgi complex, functions of Golgi complex (protein glycosylation, lipid and polysaccharide metabolism, protein sorting and secretion, Golgi Anti-Apoptotic Protein -GAAP)
2.3	Lysosomes: Origin, occurrence, polymorphism and functions; Peroxisomes: Origin, morphology & functions

2.4	Mitochondria: Ultrastructure, chemical composition, functions of mitochondria and bioenergetics (Chemical energy & ATP, Krebs's cycle, respiratory chain and oxidative phosphorylation)
UNIT 3	Biomolecules (15 LECTURES)
3.1	Biomolecules: Concept of micromolecules and macromolecules
3.2	Carbohydrates: <ul style="list-style-type: none"> ● Definition classification, properties and isomerism, glycosidic bond ● Structure of Monosaccharides (glucose and fructose); Oligo-saccharides (lactose and sucrose); Polysaccharides (cellulose, starch, glycogen and chitin) Biological role and clinical significance
3.3	Amino Acids and Proteins: <ul style="list-style-type: none"> ● Basic structure, 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 (haemoglobin) Biological role and clinical significance
3.4	Lipids: <ul style="list-style-type: none"> ● 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); Steroids (cholesterol) Biological role and clinical significance
3.5	Vitamins: <ul style="list-style-type: none"> ● Water soluble vitamins (e.g. Vit C, Vit B₁₂) ● Lipid soluble vitamins (e.g. Vit A, Vit D) Biological role and clinical significance

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1. Cell Biology, Singh and Tomar, Rastogi Publication.
2. Cell and Molecular Biology, E.D.P De Robertis and E.M.R Robertis, CBS Publishers and Distributors.
3. The cell, A molecular approach, Geoffrey M. Coper ASM Press Washington D.C.
4. A textbook of cytology Suruchi Tyagi Dominant Publishers and Distributors New Delhi.
5. Cell and molecular biology, Gupta P. K., Rastogi Publication, India.
6. Cell Biology, Pawar C.B. Himalaya publication
7. Molecular Biology of the cell, (6th ed) by the Insertus
8. Principles of Biochemistry, 2005, 2nd and 3rd edn. Lehninger A.L. Nelson D.L. and Cox M.M ,
9. Biochemistry, Dushyant Kumar Shirma, 2010, Narosa Publishing house PVT.Ltd.
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11. A Textbook of Biochemistry, 9th edition, Dr. Rama Rao A.V.S.S and Dr A Suryalakshmi.

12. Biochemistry- G Zubay, Addison Wesley, 1983
 13. Biochemistry, L Stryer, 3rd/4th/5th ed, 1989, Freeman and Co. NY
 14. Harper's Biochemistry, 1996, 26th edition, Murray R.K. Granner D.K. Mayes P.A. Rodwell V.M. Hall international USA
 15. Outline of Biochemistry, 1976, E.E. Conn and P.K. Stumpf. John Wiley and Sons USA

NAME OF THE COURSE	COMPARATIVE EMBRYOLOGY, ASPECTS OF HUMAN REPRODUCTION, POLLUTION AND ITS EFFECT ON ORGANISMS	
CLASS	FYBSC ZOOLOGY	
COURSE CODE	US.ZOO.4.03	
NUMBER OF CREDITS	2	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	25	75
PASSING MARKS	10	30

COURSE OBJECTIVES:

CO 1.	To acquaint the learner with key concepts of embryology
CO 2.	To acquaint the learners with different aspects of human reproduction including issues related to infertility
CO 3.	To provide a panoramic view of impact of human activities leading to pollution and its implications.

COURSE LEARNING OUTCOMES:

CLO 1.	Learner will be able to describe the various stages of development
CLO 2.	Learners will be able to understand human reproductive physiology and advances in ART and related ethical issues.

CLO 3.	The learners will be able to relate the adverse effects of pollution and measures to control it.
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UNIT 1	Comparative Embryology (15 LECTURES)
1.1	Types of Egg- Based on amount and distribution of yolk
1.2	Structure and Types of Sperm
1.3	Types of Cleavage
1.4	Types of Blastula
1.5	Types of Gastrula
1.6	Coelom -Formation and types
UNIT 2	Aspects of Human Reproduction (15 LECTURES)
2.1	Human reproductive system and hormonal regulation 2.1.1: Anatomy of human male and female reproductive system 2.1.2: Hormonal regulation of reproduction and impact of age on reproduction - menopause and andropause
2.2	Contraception & birth control 2.2.1: Difference between contraception and birth control 2.2.2: Natural Methods: Abstinence, rhythm method, temperature method, cervical mucus or Billings method, coitus interruptus, lactation , amenorrhea 2.2.3: Artificial methods : Barrier methods, hormonal methods, intrauterine contraceptives, sterilization, termination, abortion
2.3	Female infertility: 2.3.1: Causes: Failure to ovulate; production of infertile eggs; damage to oviducts (oviduct scarring and Pelvic inflammatory disease -PID, TB of oviduct), Uterus (TB of uterus and cervix) 2.3.2: Infertility associated disorders: Endometriosis, Polycystic Ovarian Syndrome (PCOS), Primary ovarian failure(POF),Sexually Transmitted Infections (STIs) - gonorrhoea, chlamydia, syphilis and genital herpes; Antibodies to sperm; Genetic causes- recurrent abortions
2.4	Treatment of infertility 2.4.1: Removal /reduction of causative environmental factors 2.4.2: Surgical treatment 2.4.3: Hormonal treatment- fertility drugs 2.4.4: Assisted Reproductive Technology (ART) - <i>Invitro</i> fertilization (IVF); Embryo transfer (ET); Intra-Fallopian transfer (IFT), Gamete Intra-Fallopian Transfer (GIFT) & Intra-Zygote Transfer (ZIFT); Intra-cytoplasmic Sperm Injection (ICSI) with ejaculated sperm and sperm retrieved from testicular biopsy; Testicular sperm extraction (TESE).

	2.4.5: Sperm bank, cryopreservation of gametes and embryos 2.4.6: Surrogacy
UNIT 3	Pollution and its effect on organisms (15 LECTURES)
3.1	Air Pollution 3.1.1: Types and sources of air pollutant 3.1.2: Effects of air pollution on organisms, its control and abatement measures
3.2	Water Pollution 3.2.1: Types and sources of water pollutant 3.2.2: Effects of water pollution on organisms, its control and abatement measures
3.3	Soil Pollution 3.3.1: Types and sources of soil pollutant 3.3.2: Effects of soil pollution on organisms, its control and abatement measures
3.4	Sound pollution 3.4.1: Different sources of sound pollution 3.4.2: Effects of sound pollution on organisms, its control and abatement measures
3.5	Pollution by radioactive substances
3.6	Pollution by solid wastes 3.6.1: Types and sources 3.6.2: Effects of solid waste pollution, its control and abatement measures
3.7	Pollution leading to Climate Change and Global Warming

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10. Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
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17. Water Pollution, Kudesia V. P., Pragati Prakasan, Meerut
18. A text book of Environmental Chemistry and Pollution Control, S. S. Dogra, Swastic Pub, New Delhi
19. Practical Methods for water and Air Pollution Monitoring, S. K. Bhargava, New Age International
20. Hand Book of Water and waste water Analysis, Kanwaljit Kaur, Atlantic
21. Aquatic Pollution by Edward A. Laws
22. Environmental Science and Technology, Stanely E. Manahan
23. Environmental Chemistry, A. K. De, New Age International
24. A Text Book of Environmental Studies, Gurdeep R. Chatwal, Harish Sharma, Madhu Arora

PRACTICAL COURSE US.ZOOP.4

<u>PRACTICAL I</u>	
1	Study of population density by Line transect method & Quadrant method and calculate different diversity indices. <ul style="list-style-type: none"> ● Index of Dominance ● Index of frequency ● Rarity Index ● Shannon Index ● Index of species diversity
2	Study of prokaryotic cells (bacteria) by Crystal violet staining technique
3	Study of eukaryotic cells (WBCs) from blood smear by Leishman's stain
4	Identification and study of fossils: <ul style="list-style-type: none"> ● Arthropods: Trilobite ● Mollusca: Ammonite

	<ul style="list-style-type: none"> • Aves: Archaeopteryx
5	<p>Identification of</p> <ul style="list-style-type: none"> • Allopatric speciation (Cyprinodont species) • Sympatric speciation (Hawthorn fly and Apple maggot fly) • Parapatric speciation (Snail)
6	Bibliography/ Abstract writing
7	<p>Preparation of Power Point Presentation based on research paper.</p> <p style="text-align: center;">PRACTICAL II</p> <ol style="list-style-type: none"> 1) Study of permeability of cell through plasma membrane (osmosis in blood cells) 2) Measurement of cell diameter by oculometer (by using permanent slide) 3) Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Barfoed's test, Anthrone test) 4) Qualitative tests for protein (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test) 5) Qualitative test for lipids (Solubility test, Sudan III test) 6 Study of rancidity of lipids by titrimetric method 7) Ultrastructure of cell organelles (Electron micrographs) of: <ul style="list-style-type: none"> • Nucleus • Endoplasmic reticulum (Smooth and Rough) • Mitochondria. • Golgi apparatus • Lysosomes 8) Study of clinical disorders due to carbohydrates, proteins and lipid imbalance (Photograph to be provided / symptoms to be given and

disorder to be identified):

- Hyperglycemia
- Hypoglycemia
- Anaemia
- Kwashiorkar
- Marasmus
- Fatty liver

PRACTICAL III

1 Study of air microflora

2 Estimation of dissolved oxygen from the given water sample

3 Estimation of salinity by refractometer from the given water sample

4 Estimation of conductivity by conductometer from the given water sample

5 Study of physical properties of soil: temperature, moisture and texture

6 Study of chemical properties of soil- pH, organic matter

7 Study of sound pollution monitoring device

8 Detection of pregnancy from given sample of urine

9 Study of birth control measures applicable to humans – IUD, condom and hormonal pills.

10 Study of the following permanent slides, museum specimens and materials

a. Mammalian sperm and ovum

b. Types of egg –fish, frog and hen

c. Cleavage, blastula and gastrula (Amphioxus, Frog and Bird)

11 Review writing based on programmes telecast by Doordarshan, Gyandarshan, UGC programmes or other media sources

12 Study of natural ecosystem and field report of the visit

N.B.: The practicals could be conducted by using specimens authorized by the wildlife and such other regulating authorities. However, adhering to the directions as given in the UGC Circular F14-4/2006 (CPP-II), the practicals will be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies.
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ASSESSMENT DETAILS: (this will be same for all the theory papers)

Maximum Marks allotted for each theory course per semester: 100 marks

Internal Assessment (25 marks)

- a) Internal assessment of total of twenty five (25) marks per course per semester shall be conducted as: out of 20 marks based on the test / project and out of 5 marks based on the active participation in the class.
- b) Semester End Examination – External Assessment (75 marks)

Practical Assessment (for papers with practicals)

Maximum Marks allotted for the entire practical course per semester: 150 marks which will be distributed into the following two examination sessions and conducted as per the given question paper pattern:

- a) Practical I examination of fifty (50) marks shall be conducted at the end of every semester.
 - b) Practical II examination of fifty (50) marks shall be conducted at the end of every semester.
 - c) Practical III examination of fifty (50) marks shall be conducted at the end of every semester.
- The duration of the practical exam will be two hours.
 - The students are allowed to write the paper if the attendance for practical's is more than 45%
 - To appear in the practical exam, students must bring a properly certified journal.

PAPER PATTERN OF INTERNAL ASSESSMENT US.ZOO.4.01 , US.ZOO.4.02, US.ZOO.4.03

All Questions are compulsory

Figures to the right indicate full marks

Time: 50 minutes

Total marks: 20

Q.1.	*Objective type questions	05 marks
Q.2.	Answer in one sentence OR Define the following	05 marks
Q.3.	Answer any two out of three (05 marks each)	10 marks

**PAPER PATTERN OF THEORY EXTERNAL ASSESSMENT
US.ZOO.4.01 , US.ZOO.4.02, US.ZOO.4.03**

All Questions are compulsory

Figures to the right indicate full marks

Time: 2.5 hours

Total marks: 75

Q.1.	Based on UNIT 1 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.2.	Based on UNIT 2 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.3.	Based on UNIT 3 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.4.	Based on all three units – two from each unit Answer any three out of six (5 marks each)	15 marks

PAPER PATTERN OF PRACTICAL EXAMINATION

US. ZOOP.4

PRACTICAL I EXAMINATION

Time: 2 hrs 30 min

Marks: 50

Major Question

(12 marks)

Q1. Study Population density by Line transect or Quadrant method and calculate Biodiversity Indices. (Any 2)

Minor Question

(08 marks)

Q2. Prepare a smear to show prokaryotic cell.

OR

Q2. Prepare a smear to show eukaryotic cell.

Q3. Identify and describe as per instructions

(08 marks)

a) Fossil b) Speciation

Q4. From the given article, prepare the bibliography/ abstract.

(06 marks)

Q5. Submission of Power point presentation.

(06 marks)

Q6. Viva.

(05 marks)

Q7. Journal.

(05 marks)

PRACTICAL II EXAMINATION

Time: 2 hrs 30 min

Marks: 50

Major Question

(15 marks)

Q1. Study of osmosis in RBCs.

OR

Q1. Measurement of cell diameter by occulometer using permanent slide.

Minor Question

(10 marks)

Q2. Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Fehling's test, Anthrone test)

OR

Q2. Qualitative tests for protein (Ninhydrin test, Biuret test, Millon's test, Xanthoprotein test)

OR

Q2. Qualitative test for lipid (Solubility test, Sudan III test)

OR

Q2. Estimation of rancidity of lipids by titrimetric method

Q3. Identify and describe as per instructions (15 marks)

- Ultrastructure of cell organelles (a, b & c)
- Clinical disorders (d & e)

Q4. Viva (05 marks)

Q5. Journal (05 marks)

PRACTICAL III EXAMINATION

Time: 2 hrs 30 min

Marks: 50

Major Question

(12 marks)

Q1. Estimation of Dissolved Oxygen from the given water sample.

OR

Q1. Detection of pregnancy from given sample of urine.

OR

Q1. Determination of organic matter from the given soil sample.

Minor Question

(08 marks)

Q2. Estimation of salinity by refractometer from the given water sample.

OR

Q2. Estimation of conductivity by conductometer from the given water sample.

OR

Q2. Determination the pH of the given soil sample.

OR

Q2. Determine the texture of the given soil sample.

Q3. Identify and describe as per instructions (15 marks)

- Permanent slides on embryology (a & b)
- Birth control measure (c)
- Fishery (d & e)

- Q4. a) Field report submission (06 marks)
b) Viva based on field report (04 marks)
- Q5. Journal (05 marks)