

**SIDO KANHU MURMU UNIVERSITY,
DUMKA**



**CBCS BASED
COURSE CURRICULUM
(ZOOLOGY)
For
UNDERGRADUATE
PROGRAMME**

[B.Sc. (Honours) / (Subsidiary/ General)]
ACADEMIC SESSION
2017-2019

UNIVERSITY DEPARTMENT OF ZOOLOGY
S.K.M.UNIVERSITY, DUMKA - 814101
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**B.Sc. ZOOLOGY (HONOURS) SEMESTER SYSTEM
(S.K.M.UNIVERSITY, DUMKA)**

**ABSTRACT OF SYLLABUS OF CORE SUBJECT
(3 YR DEGREE COURSE UNDER SEMESTER SYSTEM)**

YEAR	SEMESTER	T H E O R Y			PRACTICAL FULL MARKS	TOTAL MARKS (T+P)
		PAPER CODE	COURSE TITLE	FULL MARKS		
1st	Sem- I	ZOO-101C	Animal diversity(Non chordates)- 1	75	50	200
		ZOO-102C	(A) Animal Diversity(Non chordates(-2 (B)Animal behaviour	75		
	Sem- II	ZOO-203C	Animal Diversity(Chordates)	75	50	200
		ZOO-204C	(A) Comparative Anatomy of vertebrates (B) Ecology & Environmental Biology	75		
2nd	Sem- III	ZOO-305C	(A) Biostatistics (B) Evolution	75	50	200
		ZOO-306C	Biochemistry	75		
	Sem- IV	ZOO-407C	(A) Palaeontology (B) Genetics	75	50	200
		ZOO-408C	Molecular Biology	75		
3rd	Sem- V	ZOO-509C	(A) Toxicology (B) Biotechnology (C) Zoogeography	100	100	400
		ZOO-510C	Endocrinology & Reproductive Biology	100		
		ZOO-511C	Cell Biology	100		
		ZOO-512C	(A) Practical – 75 (B) Project - 25			
	Sem- VI	ZOO-613C	(A) Applied & Economic zoology (B) Immunology	100	100	400
		ZOO-614C	Mammalian Physiology	100		
		ZOO-615C	Developmental Biology	100		
		ZOO-616C	(A) Practical – 75 (B) Project - 25			

THEORY: END SEMESTER EXAMINATION
Pattern of questions & Distribution of Marks

Group	Theory Full Marks : 75 Time : 3 hours	Theory Full Marks : 100 Time : 3 hours
A	Objective Type Multiple Choice Questions : 10 x 2 = 20 Marks	Objective Type Multiple Choice Questions : 10 x 2 = 20 Marks
B	Short Answer Type Questions Five questions (Out of ten questions) 5 x 5 = 25	Short Answer Type Questions Five questions (Out of ten questions) 5 x 8 = 40
C	Long Answer Type Questions Two questions (Out of Four Questions) 2 x 15 = 30 Marks	Long Answer Type Questions Two questions (Out of Four Questions) 2 x 20 = 40 Marks

P R A T I C A L (HONOURS): END SEMESTER EXAMINATION

MODEL OF QUESTIONS & DISTRIBUTION OF MARKS

SEMESTER ; IST Full Marks : 50 Time : 3hrs			SEMESTER : IIND Full Marks : 50 Time : 3 hrs		
SN	Model of questions	Marks	SN	Model of questions	Marks
1	Dissection	10	1	Dissection	10
2	Mounting	5	2	Mounting	5
3	Spotting(Slides 4 +Specimen 2)	12	3	Spotting(Slides 4 +Specimen 2)	12
4	Animal Behaviour	8	4	Ecology &Environmental biology:1exp	8
5	Viva	5	5	Viva	5
6	Collection/Record	10	6	Collection/Record	10
TOTAL		50	TOTAL		50
SEMESTER : IIIRD Full Marks : 50 Time : 3 hrs			SEMESTER : IVTH Full Marks : 50 Time : 3 hrs		
SN	Model of questions	Marks	SN	Model of questions	Marks
1	Biostatistics	10	1	Palaeontology	10
2	Evolution	5	2	Genetics	10
3	Osteology-2	8	3	Molecular biology	5
4	Biochemistry:1exp	12	4	Osteology -2	10
5	Viva	5	5	Viva	5
6	Collection/Record	10	6	Collection/Record	10
TOTAL		50	TOTAL		50
SEMESTER : VTH Full Marks : 100 Time : 3Hrs (A)Practical – 75 (B)Project - 25			SEMESTER : VITH Full Marks :100 Time : 3 Hrs (A)Practical – 75 (B)Project - 25		
SN	Model of questions	Marks	SN	Model of questions	Marks
1	Endocrinology &Reproductive biology	15	1	Applied economic zoology	15
2	Biotechnology	10	2	Immunology	10
3	Toxicology	15	3	Mammalian physiology	15
4	Cell biology	15	4	Developmental biology	15
5	Viva	10	5	Viva	10
6	Collection/Record	10	6	Collection/Record	10
T O T A L		75	T O T A L		75
PROJECT		25	PROJECT		25

S.K.M.University, Dumka
B.Sc: ZOOLOGY (HONOURS) SEMESTER SYSTEM

1st year

Semester – I

THEORY (CORE)

Paper- 1ST (ZOO – 101C)

Full Marks: 75

Animal diversity (Non chordates): I

1. Preliminary knowledge of classification of Non-chordates.
2. Protozoa
 - (i) Type study- Entamoeba histolytica
 - (ii) Nutrition and Reproduction in protozoa
3. Porifera-
 - (i) Type study- Scypha
 - (ii) Canal system in Porifera.
4. Coelenterata
 - (i) Type study-Obelia
 - (ii) Coral and coral reef formation.
5. Ctenophora: General organization and affinities of Hormiphora
6. Helminthes.
 - (i) Type study-Faciola hepatica,Wuchereia bancrofti
 - (ii) Parasitic adaptations.
7. Annelida:
 - (i) Type study: Leech
 - (ii) Coelom & Excretory system in annelids

A. Animal diversity (Non chordates) : II

1. Mollusca
 - (i) Type study- Pila
 - (ii) Torsion and detorsion in Gastropods
2. Arthropoda
 - (i) Type study- Peripatus
 - (ii) Crustacean larvae
 - (iii) Mouth parts in insects.
3. Echinodermata
 - (i) Type study -Asterias
 - (ii) Larval forms of Echinoderms
 - (iii) Water vascular system in Echinoderms
4. Hemichordata- General characters and affinities.

B. Animal behaviour

1. Scope and concept of animal behaviour
2. Innate and learned behaviour
3. Social behaviour in insects(a) Honey bee(b)Termites
4. Parental care in fishes
5. Parental care in amphibians
6. Nesting and brooding behaviour in birds

P R A C T I C A L

FULL MARKS: 50

List of Practical

1. Dissections

- Earthworm:- Alimentary canal, Nervous system
- Pila : Nervous system
- Prawn: Nervous system

2. Mounting

- Coelenterata- Obelia
- Earthworm :-Setae,Spermathecae,Ovary,Septal nephridia
- Arthropoda :- statocyst of Prawn
- Mollusca :- Osphradium,Radula-Pila, statocyst

3. Study of Microscopic Slides

- Protozoa- Amoeba, Entamoeba, Euglena, Vorticella, Plasmodium, Paramecium.
- Porifera : Sycon, Spicules
- Coelentrata : Hydra, Obelia
- Helminthes: Ascaris : T.S Body wall (Male, Female), Larvae of F. hepatica
- Annelida- Earthworm: T.S-through pharynx, gizzard, spermatheca, seminal vesicles
- Arthropoda: Crustacean -Nauplius, Zoea, Megalopa, Mysis, (Larva)
Cyclops, Cypris, Daphnia
- Hemichordata: T.S. through branchiogenital region of
Balanoglossus, M.L.S. through anterior part of Balanoglossus

4. Study of Museum Specimens

- Porifera: Sycon
- Coelentrata : Aurelia, Porpita, Physalia, Velella, Metridium, Tubipora
- Ctenophora : Hormiphora
- Helminthes : Taenia solium, Fasciola hepatica, Ascaris
- Annelida: Nereis, Aphrodite, Sipunculus
- Arthropoda: Limulus, Sacculina, Julus, Praying mantis, Dragon fly
- Mollusca :- Chiton, Cypraea, Sepia, Pecten, Octopus.
- Echinodermata: -Star fish, Cucumaria
- Hemichordata : Balanoglossus

5. Animal behaviour

- Study of specimens showing parental care in fishes /amphibia
- 2. Comment upon models of animal behaviour
- Study trip to Zoo for observing behaviour of animals.
- Field survey of animal behaviour

Semester – II

THEORY (CORE)

Paper- 3rd (ZOO – 203C)

Full Marks: 75

Animal Diversity-Chordates

1. Origin and general characters of chordates.
2. Outline Classification of chordates
3. Protochordata-General organisation of Urochordates and Cephalochordates.
4. Agnatha-Petromyzon-general organisation.
5. Fishes- (i) Type study- Scoliodon
(ii) Dipnoi-general organisation and affinities.
6. Amphibia-Origin and evolution of amphibian
7. Reptilia- Origin and evolution of reptiles
8. Aves-(i) Origin of birds (ii) Flight adaptation.
9. Mammals-General organisation, distribution and affinities of Prototheria and metatheria.

PAPER: 4TH (ZOO – 204C)

FULL MARKS: 75

A. Comparative anatomy of vertebrates

Integument, Heart, Aortic arches, Urinogenital system and Brain.

B. Ecology and Environmental Biology

- 1 .Concept of Ecology and Environmental Biology.
- 2 .Concept of Biosphere(Lithosphere,Hydrosphere and Atmosphere).
- 3 .Ecosystem-Definition,structure and function of a typical ecosystem.
4. Major ecosystems of the world.5.Biogeochemical cycles.
- 5 .Concept of flow of energy in an ecosystem.
- 6 .Biogeochemical cycles.
7. Community structure and ecological sucession.
8. Concept of global warming and its remedies.
9. Wild life management.

PRACTICAL

FULL MARKS: 50

List of Practical

1. DISSECTION!

- Scoliodon: Afferent and efferent blood vessels, Cranial nerves (5th, 7th, 9th, 10th)
- Bony fish- (Video graphic demonstration)
- General anatomy- Pigeon (CD-Rom or Video graphic demonstration)
- Rat : General anatomy (CD-Rom or Video demonstration or Model or casts)

2. MOUNTING

- FISH:- Placoid, Cycloid, Ctenoid and Rhomboid Scales, Ampula of Lorenzini.
- Aves :- Feathers, Pecten of pigeon (Still photographs on TV or Computer monitor demonstration)

3. STUDY OF PERMANENT SLIDES

- **Amphioxus**:- W.M., T.S. Pharynx, Intestine, Caudal region
- **Fish : scales (w.m)**
- Mammals : Skin, Stomach, Intestine, Liver, Kidney, Ovary, Testis, Spinal cord

4. STUDY OF MUSEUM SPECIMENS

- Urochordata :- Herdmania
- Cyclostomes :- Petromyzon
- Fishes : Torpedo, Hammer headed shark, Hippocampus, Exocoetus, Sucking fish, Anabas testudeneus, Channa punctatus, Clarias batrachus, Heteropneustes fossilis, Catla catla, Labeo rohita,
- Amphibia : Ichthyophis, Axolotl larva, Salamandra, Hyla, Alytes
- Reptilia : Tortoise, Sphenodon, Chameleon, Draco Python, Bungarus, Naja, Sea snake
- Aves- Owl, Pigeon
- Mammal- Bat

5. Ecology and Environmental Biology

- General ecological survey of- Pond, Riverine, Grass land, Forest ecosystems of your locality.- survey report
- Limnological studies of Pond- Temperature, pH, Dissolved oxygen turbidity Plank tonic studies
- Community structure analysis of grassland
- Physical characteristics of soil sample
- Moisture and water holding capacity of

2nd year

Semester – III

THEORY (CORE)

Paper- 5th ^T (ZOO – 305C)

Full Marks: 75

A. Biostatistics

1. Concept and scope of biostatistics.
2. Normal distribution and mean, mode and median
3. Standard deviation and standard error.
4. Students 't' test
5. Chi square test.

B. Evolution

1. Origin and evolution of life on earth
2. Concept and theories of evolution-Lamarckism, NeoLamarckism, Darwinism and Neo Darwinism.
3. Synthetic theory of evolution
3. Causes of hereditary variations and role in evolution.
4. Concept of isolating mechanism and its role in evolution.
5. Speciation and natural selection.

Paper- 6th (ZOO – 306C)

Full Marks: 75

Biochemistry

1. Carbohydrates- structure, classification and significance
2. Protein -Structure, classification and significance.
4. Lipids- structure, classification and significance.
5. Amino acids-structure and properties.
6. Enzymes-Classification, nature and mechanism of action.
7. Vitamins-Discovery, sources and deficiency states.
8. Metabolic pathways-Glycolysis, glycogenesis, Gluconeogenesis, Krebs cycle, β oxidation of fatty acids.

PRACTICAL

FULL MARKS: 50

LIST OF PRACTICALS

Biostatistics:

Calculation, evaluation and inter presentation of result on the basis of statistical analysis of the provided sample data (with the help of calculator)

1. Arithmetic mean
2. Mode
3. Median
4. Standard deviation and standard error
5. Students'- t test

Evolution

1. Experiment showing Homology and analogy in wings of bird, bat and Butterfly
2. Experiment showing serial Homology in appendages of Prawn.
3. Experiment showing adaptive radiation in beak of birds
4. Experiment showing adaptive radiation in feet of birds
5. Experiment showing adaptive radiation in dentition of Mammal

OSTEOLOGY

-Study of Vertebrae & Limb bones of Frog, Amphibia, Reptilia, Aves and Mammal

Biochemistry

1. Tests for carbohydrates-Iodine test, Benedict's test
2. Tests for proteins-Biuret test, Millons test'
3. Tests for lipids-solubility test, Acrolein test,
4. Test for salivary amylase enzyme activity and impact of temperature and pH on salivary amylase activity.
9. Separation blood corpuscles and plasma by centrifugation

Semester – IV

THEORY (CORE)

Paper- 7TH (ZOO – 407C)

Full Marks: 75

A. Palaeontology

1. Fossils and methods of fossil formation.
2. Geological time scale and distribution of animals.
3. Phylogeny of horse
4. Phylogeny of Man.

B. Genetics

1. Concept of Mendelism and Mehdel's laws.
2. Linkage and Crossing over.
3. Cytoplasmic inheritance.
4. Chromosomal aberrations with cytological and genetic; manifestations.
5. Gene mutation.
6. Interaction of genes.

Paper- 8TH (ZOO – 408C)

Full Marks: 75

Molecular Biology

1. DNA-structure and types.
2. DNA-replication.
3. DNA damage and repair
4. RNA-its various types.
5. Transcription and genetic code.
6. Protein synthesis.
7. Regulation of gene expression

PRACTICAL

FULL MARKS: 50

List of Practical

Palaeontology

1. Study and comment upon the fossil or models of fossil provided.-
2. Models of extinct reptiles, Archaeopteryx

GENETICS: Calculation and interpretation of result of sample data showing-

1. Mendelian monohybrid cross, dihybrid cross
2. Ratio of crosses of sex linked inheritance.
3. Study of Phenotypic traits in Drosophila
4. Study of Phenotypic traits in Pea plant

Molecular Biology

- i. Genomic DNA extraction from whole human blood
- ii. Technique of DNA Finger printing

Osteology:

Study of Girdles & skull bones of Frog, Amphibia, Reptilia, Aves and Mammal

3rd year

Semester – V

THEORY (CORE)

Paper- 9TH (ZOO – 509C)

Full Marks: 100

A. Toxicology

1. Introduction, basic concepts of Toxicology.
2. Toxicological testing methods-Acute toxicity tests, subacute toxicity tests and chronic toxicity tests.
3. Toxicants of public health hazards-toxic chemicals-pesticides, heavy metals, fertilizers, food additives, automobile emissions, radioactive substances.

B. Biotechnology

1. Introduction and scope of biotechnology
2. Brief idea of recombinant DNA technology and genetic engineering.
3. Transgenic animals.

C. Zoogeography

1. Various Zoogeographical regions of the world
2. Geographical areas, physical features, and distribution of animals of Australian, Oriental and Ethiopian regions

Paper- 10TH (ZOO – 510C)

Full Marks:- 100

Endocrinology and Reproductive Biology

1. Anatomy, histology and nature and function of hormones secreted by Pituitary, Thyroid, Adrenal, Gonad and Islets of Langerhans.
2. Reproductive cycles in mammals. Oestrous and menstrual cycles.
3. Vertebrate
4. Invertebrate neuroendocrine system.
5. Mechanism of hormonal action.
6. Hormonal regulation of gametogenesis in males and females.
7. Accessory sex organs and their dependence on sex hormones.
8. Human genetic disorders related to endocrine system

Paper- 11TH (ZOO –511C)

Full Marks: 100

Cell Biology

1. Structure and functions of various cell organelles-Plasma membrane, Endoplasmic reticulum, Mitochondria, Golgi complex, Ribosomes, Lysosomes, Nucleus, Nucleolus
2. Fine structure of chromatin fibres.
3. Cell cycles-Mitosis and Meiosis.

Paper- 12TH (ZOO –512C)

Full Marks: 100

A. PRACTICAL : 75

Endocrinology and Reproductive Biology

1. Slides-T.S-Pituitary, Thyroid, Adrenal, Pancreas, Ovary, Testis
2. Dissection of Rat showing-Pituitary, Thyroid, Adrenal, Pancreas, Ovary, Testis

Biotechnology

1. Principles of PCR
2. Principles techniques and use of recombinant DNA technology

Toxicology

1. Reading of opercular beating time and effects of various toxicants in air breathing fishes.
2. Reading of surfacing time and effects of various toxicants in air breathing fishes

Cell Biology

1. 1. Demonstration of Mitochondria in human buccal epithelium-vital staining by Janus green.
2. Demonstration of secretory granules-salivary gland of Cockroach-by neutral red
3. Demonstration of salivary gland chromosome in Chironomous larva.
4. Demonstration of different stages of mitosis in onion root tip-by acetocarmine
5. Demonstration of different stages of meiosis in grass hopper testis.

B.PROJECT : 25

Will be decided & assigned by faculty members

Semester – VI
THEORY (CORE)
Paper- 13TH (ZOO – 613C)

Full Marks: 100

A. Applied and Economic Zoology

1. Introduction and scope of applied and economic zoology.
2. Inland and marine fisheries in India
3. Sericulture
4. Lac culture
5. Apiculture
6. Prawn culture
7. Pearl culture.

B. Immunology

1. Introduction and scope of Immunology.
2. Immunity-cells,tissue,and molecules of immune system.
3. Antigens and antibodies - types, structure and interactions.
4. Monoclonal antibodies.
5. Cytokines.
6. ELISA and vaccines

Paper- 14TH (ZOO – 614C)

Full Marks:- 100

Mammalian Physiology

1. Blood-Composition and function of blood and lymph.
2. Cardiac cycle and ECG.
3. Respiration-
 - (a) Mechanism and control of breathing.
 - (b) Transport of Oxygen and Carbon dioxide.
4. Digestion and absorption of dietary constituents.
5. Physiology of urine formation and acid base balance.
6. Physiology of muscle contraction(Skeletal muscles).
7. Physiology of nerve conduction and synaptic transmission(Neuronal function).

Paper- 15TH (ZOO – 615C)

Full Marks: 100

Developmental Biology

1. Gametogenesis.
2. Fertilization.
3. Parthenogenesis.
4. Types of eggs and pattern of cleavage and significance.
5. Process of gastrulation in frog and chick.
6. Development of chick upto three germ layers.
7. Development and functions of extra embryonic membranes in chick
8. Organogenesis of heart, brain and eye in chick.
9. Placenta in mammals.

A. PRACTICAL :- 75

Applied and Economic Zoology

Comment upon the economic importance of specimens provided-

- (i) Life cycle of silk worm
- (ii) Honey bee
- (iii) Lac insects
- (iv) Fishes-*Labeo, Catla, Channa, Clarias, Mystus, Heteropneustes* .
- (v) Survey of animals of your locality having economic importance
-a brief survey report

Immunology

1. Determination of human blood group
2. Principles of ELISA

Mammalian Physiology

1. RBC total count.-Frog
2. WBC total count.-Frog
3. Estimation of Haemoglobin-Frog
4. Bleeding and clotting time.
5. Preparation and staining of blood film and interpretation of result after light microscopy

Developmental Biology: Slides-

- (i) Morula, Blastula, Gastrula of frog
- (ii) Whole mount of-chick embryo-18, 24,33,48,72 and 96 hrs

A. PROJECT :- 25

Will be decided & assigned by faculty members

Skill Enhancement Course (SEC)

Semester III

SEC – 1

Fish Farming

Credit 2

Teaching Hrs – 24

FM – 50

UNIT – 1 -

Fish resources in India

UNIT – 2

Induced breeding and seed production of carps

UNIT – 3

Polyculture of fin fishes and exotic fishes (Methods Problem and Precaution)

UNIT – 4

Fish By Product

UNIT – 5

Fish Diseases (Pathogen Symptoms and control)

Semester IV
SEC – 2
Vermi-culture & composting
Teaching Hrs.– 24

Credit 2

FM–50

- UNIT – 1 : Physical properties of the soil – texture, colour and types of soils, soil organisms.
- UNIT – 2 : Chemical properties of soil – pH, Conductivity, organic matter, Nitrogen, Phosphate and Potassium.
- UNIT – 3 : Composting – anaerobic composing, aerobic composing, vermin compost – earthworm species used.
- UNIT – 4 : Vermicompost and role of vermicompost in organic farming – its quality and advantages over chemical inputs.

Semester V
SEC – 3
Museum- Collection & Preservation
Credit 2 Teaching Hrs – 24 FM–50

- UNIT – 1 : Preservative – Types of preservatives, their preparation
- UNIT – 2: Collection – Equipments used in collection (Insect Net, Aspirator,),
Methods of Collection.
- UNIT – 3 : Storage and preservation of specimens
- UNIT – 4 : Taxonomic documentation
- UNIT – 5 : Maintenance of Museum Specimens

Semester VI
SEC – 4
Aquarium & Fish Keeping
Teaching Hrs. – 24

Credit 2

FM – 50

- UNIT – 1 : Scope of aquarium fish as a Cottage Industry. Exotic and Endemic species of Aquarium fishes.
- UNIT – 2 : Common Characters and sexual dimorphism of fresh water and marine Aquarium fishes.
- UNIT -3 : Food and feeding of Aquarium fishes – Use of live fish feed organisms. Preparation and composition of fish feed.
- UNIT – 4 : Live fish transport – Fish handling Packing and transport techniques
- UNIT – 5 : General Aquarium maintenance – budget for setting up an aquarium fish farm as a cottage industry.

Semester II

Teaching Hrs. – 60

FM – 75

Credit - 4

Ability Enhancement Compulsion Course – (AECC)

Environmental Science

UNIT – 1 : General Concept

1.1 Components of ecosystem.

1.2 Energy flow in ecosystem.

1.3 Food chain and food web.

1.4 Biogeochemical cycle.

1.4.1 Water cycle

1.4.2 Carbon cycle and Nitrogen cycle

UNIT – 2 Population communities

2.1 Population characteristics – Density, Natality, Mortality

2.2 Nature, Structure and attributes of biological communities

2.3 Ecological succession and concept of climax

UNIT – 3 Pollution

3.1 Sources of impact of environmental pollutants – air, water and soil.

3.2 Global environmental changes – Green house gases and their effects

3.3 Acid rain and global warming

UNIT-4 Natural resources

4.1 Soil, water, mineral resources and their conservation

4.2 Biodiversity – Benefits, hotspots, threats and conservation

4.3 Human impact on mineral resources.

4.4 Renewable and non renewable source of energy.

Practical Environmental Science

Credit – 2

Hours of working – 30

FM-25

Time – 1.30 Hrs.

1. Ecological practical –	10
2. Spotting	
a. Slides	02 x 2 = 04
b. Specimen	02 x 3 = 06
3. Practical record and viva	05
	<hr/>
	25

List of suggested practical

1. Estimation of dissolved oxygen
2. Estimation of free carbon dioxide.
3. Study of food chain through model.

S.K.M.UNIVERSITY, DUMKA
B.Sc.: ZOOLOGY (Subsidiary /General) SEMESTER SYSTEM

ABSTRACT OF SYLLABUS

Year	Semester	THEORY			PRACTICAL			MARKS (T + P)
		PAPE R	COURSE TITLE	FULL MARKS	MODEL OF QUESTIONS			
1 st yr (S/G)	SEM. -I	Z-101	A. Animal Diversity(Non chordate)-I B. Animal behaviour	75	SN	Model of questions	Marks	100
					1	Dissection	4	
					2	Mounting	2	
					3	Spotting:4(slides-2 +specimens-2)	6	
					4	Animal behaviour	4	
					5	Viva	5	
					6	Collection/Record	4	
					T o t a l		25	
	SEM.II	Z-202	A. Animal diversity(Non chordates) – II) B. Ecology	75	SN	Model of questions	Marks	100
					1	Dissection	4	
					2	Mounting	2	
					3	Spotting:4 (Slides-2 + specimens-2)	6	
					4	Ecology	4	
					5	Viva	5	
					6	Collection/Record	4	
					T o t a l		25	
2 nd yr (S/G)	SEM-III	Z-303	A. Animal Diversity(Chordates) B. Endocrinology	75	SN	Model of questions	Marks	100
					1	Dissection	4	
					2	Mounting	2	
					3	Spotting:4(slides-2+specimens-2+Bones-2)	6	
					4	Endocrinology (slide)	4	
					5	Viva	5	
					6	Collection/Record	4	
					T o t a l		25	
	SEM-IV	Z-404	A. Evolution B. Palaeontology C. Genetics D. Molecular Biology	75	SN	Model of questions	Marks	100
					1	Dissection	4	
					2	Evolution/Palaeontology :1	4	
					3	Spotting:4(specimens-2+Bones-2)	4	
					4	Genetics : 1	4	
					5	Viva	5	
					6	Collection/Recoed	4	
					T o t a l		25	
3 rd yr (G)	SEM-V	Z-505	A. Toxicology B. Biochemistry c. Biotechnology D. Applied & Economic zoology	75	SN	Model of questions	Marks	100
					1	Biochemistry:1exp	5	
					2	Applied & economic zoology: 2	5	
					3	Project	8	
					4	Collection/Record	3	
					5	Viva	4	
					T o t a l		25	
	SEM-VI	Z-606	A. Cell biology B. Developmental biology C. Maamalian physiology D. Immunology	75	S N	Model of questions	Marks	100
					1	Cell biology: 1	4	
					2	Mammalian physiology:1	4	
					3	Developmental biology: 1	2	
					4	Project	8	
					5	Collection/Record	3	
					6	Viva	4	
					T O T A L		25	

S.K.M.UNIVERSITY, DUMKA

B.Sc. ZOOLOGY (subsidiary /General) SEMESTER SYSTEM

1ST YEAR (SUBDIDIARY/ GENERAL)

SEMESTER: I

THEORY

PAPER: 1ST (Z-101)

FULL MARKS: 75

A. Animal Diversity (Non chordates): I

1. Principles of classification: Silient features and classification up to Orders.
2. Protozoa : Type study – Entamoeba histolytica
3. Porifera : Type study – Scypha
4. Coelenterata : Type study – Obelia
5. Helminthes : Type study – Faciola hepatica
6. Annelida : Type study – Earthworm

B. Animal behavior

1. Innate and learned bahaviour
2. Social behavior in insects

PRACTICAL

FULL MRKS: 25

LIST OF PRACTICALS

1. DISSECTION : Earthworm

2. MOUNTING

Earthworm: Setae, Spermatheca, Septal nephredia

3. STUDY OF SLIDES

- a. Protozoa : Amoeba ,Entamoeba,Paramecium
- b. Porifera : Spicules, Gemule , T.S & L.S. of Sycon
- c. Coelenterata : W.M.,T.S & L.S. of Hydra

4. STUDY OF SPECIMENS

- a. Porifera : Sycon
- b. Coelenterata : Aurelia , Porpita ,Physalia
- c. Helminthes : Fasciola hepatica, Liver fluke , Ascaris
- d. Annelida : Earthworm , Leech

5. ANIMAL BEHAVIOUR : Study of specimens showing parental care in Fishes / Amphibia

SEMESTER: II
THEORY
PAPER: 2ND (Z-202)

Full Marks: 75

A. Animal diversity(Non chordate) – II

1. Arthropoda : Type study – Prawn
2. Mollusca : Type study – Pila
3. Echinodermata : Type study – Asterias

4. Ecology
 - i. Ecosystem: Definition, structure & function of a typical ecosystem
 - ii. Biogeochemical cycles
 - iii. Concept of flow of energy

PRACTICAL
LIST OF PRACTICALS

FULL MARKS : 25

A. DISSECTION:

- B. Prawn : Nervous system
- C. Pila : Nervous system

D. Mounting :

1. Pila : Osphradium , Radulla

E. Study of Permanent slides :

1. Helminthes : Ascaris – T.S. of Body wall (Male & female)
2. Annelida : Earthworm : T.S. of body wall, pharynx, Gizzard

F. Study of specimens

1. Arthropoda : Limulus, Scorpion , Julus, Prawn, Praying mantis, Dragon fly
2. Mollusca : Unio , Pila , Chiton , Octopus, Sepia
3. Echinodermata : Starfish

G. Ecology :

Limnological studies of Pond : Temperature , pH , Dissolved oxygen , turbidity, Planktonic studies

2nd YEAR (SUBDIDIARY/ GENERAL)

SEMESTER: III

THEORY

PAPER: 3RD (Z-303)

FULL MARKS: 75

A. Animal Diversity-Chordates

Protochordata- Amphioxus-general organization

Type study-Bony Fish

Amphibia-classification up to order

Reptilia- classification up to order

Mammalia:Prototheria and metatheria

B. Endocrinology

Anatomy, histology and nature and function of hormones secreted by Pituitary, Thyroid, Adrenal, Gonad and Islets of langerhans.

PRACTICAL

FULL MRKS: 25

LIST OF PRACTICALS

1. DISSECTION:

Dog fish: General anatomy, Afferent and efferent blood vessels,

2. MOUNTING

Placoid, Cycloid, Ctenoid scales of fishes

3. STUDY OF SLIDE: Placoid, Cycloid, Ctenoid scales of fishes

4. STUDY OF SPECIMENS

Fishes: - Torpedo, Hammer headed shark, Hippocampus, Exocoetus, Sucking fish,

Anabas testudeneus, Channa punctatus, Clarias

batrachus, Heteropneustes fossilis, Catla catla, Labeo rohita

Amphibia: - Ichthyophis, Hyla,

5. OSTEOLOGY: Study of vertebrae & Limb bones of Amphibia, Reptilia, Aves and Mammal

6. ENDOCRINOLOGY: Histological slide of endocrine glands

SEMESTER: IV

THEORY

PAPER: 4TH (Z -404)

FULL MARKS: 75

A. Evolution: Lamarckism, NeoLamarckism, Darwinism and Neo Darwinism.

B. Palaeontology : Fossils and methods of fossil formation.

C. Genetics

1. Concept of Mendelism and Mehdel's laws.

2. Linkage and Crossing over.

D. Molecular Biology

1. DNA-structure and types

2. RNA-its various types.

3. Protein synthesis.

PRACTICAL

FULL MARKS: 25

LIST OF PRACTICALS

DISSECTION: Dog fish: Cranial nerves (5th, 7th, 9th, 10th.)

EVOLUTION

1. Homology & analogy as shown by wings of bird, bat and butterfly

PALAEONTOLOGY: study & comment upon fossil or model of fossil provided

STUDY OF SPECIMENS

Reptilia: Draco, Python, Bungarus, Naja

Aves: Pigeon

Mammal: Bat

GENETICS

Calculation & interpretation of result of sample data showing : Mendelian Monohybrid cross & Dihybrid cross

Osteology-

a. Study of skull bones of Amphibia, Reptilia, Aves and Mammal

3rd YEAR (GENERAL)

SEMESTER: V

THEORY

PAPER: 5TH (Z -505)

FULL MARKS: 75

A. Toxicology: Introduction, basic concepts of Toxicology

B. Biochemistry

1. Carbohydrates- structure, classification and significance
2. Protein -structure, classification and significance.
3. Lipids- structure, classification and significance

C. Biotechnology: Introduction and scope of biotechnology

D. Applied and Economic Zoology

1. Pisciculture
3. Sericulture
4. Lac culture
5. Apiculture

PRACTICAL

FULL MARKS: 25

LIST OF PRACTICALS

Biochemistry

1. Tests for carbohydrates- Benedict's test
2. Tests for proteins-Biuret test
3. Tests for lipids-solubility test

Applied and Economic Zoology

Comment upon the economic importance of specimens provided-

- (i) Life cycle of silk worm
- (ii) Honey bee
- (iii) Lac insects
- (iii) Fishes-*Labeo, Catla, Channa, Clarias*

PROJECT: Will be decided & assigned by faculty members

SEMESTER: VI
THEORY
PAPER: 6TH (Z- 606)

FULL MARKS: 75

A. Cell Biology:

Structure and functions of various cell organelles-Plasma membranes, Endoplasmic reticulum, Mitochondria, Golgi complex, Ribosomes, Lysosomes, Chromosome, Cell cycle

B. Developmental Biology

1. Development of chick upto three germ layers.
2. Development and functions of extra embryonic membranes in chick

C. Mammalian Physiology

1. Transport of Oxygen and Carbon dioxide.
2. Digestion and absorption of dietary constituents.
3. Physiology of urine formation and acid base balance

D. Immunology

1. Introduction and scope of Immunology.

PRACTICAL

FULL MARKS: 25

LIST OF PRACTICALS

Cell Biology

1. Demonstration of Mitochondria in human buccal epithelium-vital staining by Janus green.
2. Demonstration of secretory granules-salivary gland of Cockroach-by neutral red
- 3. Mitotic and Meiotic Metaphase cell plate preparation in onion root tip and grasshopper testis respectively**

Mammalian Physiology

1. Bleeding and clotting time.
2. Preparation and staining of blood film and interpretation of result after light microscopy

Developmental Biology

Study of Whole mounts of-chick embryo-24, 48, 96 hrs

PROJECT: Will be decided & assigned by faculty members

LIST OF RECOMMENDED BOOKS

INVERTEBRATE

1. Barnes, R.D. Invertebrate Zoology -(W.B. Saunders Co.)
2. Hyman,L.H. : The Invertebrates Vi. I & II (Mc graw Hill)
3. Invertebrate structure and function : Barrington (Nelson)
4. Kotpal,Agarwal & Khetrapal : Modern Textbook of zoology:Invertebrate (Rastogi publication)
5. R.L.Kotpal : Invertebrate series – Protozoa to Minor phyla : (Rastogi publication)

CHORDATES & COMPARATIVE ANATOMY

1. The Chordates - Alexander, R.M. (Cambridge University Press)
2. The Chordates - Monath, A. R. (Cambridge University Press)
3. Chordata - Structure and Function - Waterman, A. J. (Mac Millan Co.)
4. Young,J.Z. : Life of Vertebrates (Oxford University Press)
5. Hildebrand : Analysis of vertebrates Structure (Wiley)
6. Kingsley : Outline of Comparative anatomy (Central Book Depot)
7. George C.Kent & Larry Miller : Comparative Anatomy of the Vertebrates (W.C.B Publisher)
8. Noble,G.K.,The Biology of the Amphibia(Ney York)
9. Protochordata – O.P.Saxena (S.Chand & Com.LTD)

MOLECULAR BIOLOGY & CELL PHYSIOLOGY

1. Cell and Molecular Biology - De Robertis and De Robertis (Sander's College)
2. Cell Physiology - A. Geese
3. Manual of Laboratory Exp. in Cell Biology (W.C.Brown publishers)
4. .Moleculer Biology of the Gene - Watson, J.D et al (Benzamin/ Commings)
5. Molecular Biology - Glick College Zoology: Boolotian and Stiles (Mac Miilan)
6. Molecular Cell Biology - J. Darnell et al, American Book. Inc.U.S.A.
7. Molecular Biology of the Cell-B.Alberts, et. al. Garland Publishing. Inc. New York.
8. Jha, A.P. Genes and Evolution, John Pub. N. Delhi.
9. Introduction to Parctical Molecular Biology, P.O. Dabre, John Willey & Sons Ltd.

N. York.

10. De Robertis and De Robertis : Cell and Molecular Biology (Saunders College)
11. Edward Gasque: Manual of Laboratory Exp. In cell biology (MacMillan)
12. Lodish et.al. : Molecular Cell Biology (Freeman)

ANIMAL PHYSIOLOGY

1. Animal Physiology - Eckert, R. (W. H. Freeman)
2. Review of Medical physiology, Ganong (Lange)
3. Reproductive Physiology - (Nalbandov, A.V.)
4. General & Comparative Physiology - Hoar (Prentice Hall)
5. Animal Physiology - Neilsen (Cambridge)
6. Comparative Animal Physiology - Prosser (Satish Book Enterprise)

BIOCHEMISTRY

1. Biochemistry : Stryer, L. (Freeman)
2. Outline of Biochemistry: Cornet (Wiley)
3. Biologist's Guide to Principles & Techniques of Practical Biochemistry, K. Willson & K.H. Goulding. ELBS Ed.
4. Rummel. L. Practical Biochemistry, Tata Mac Graw.

ENDOCRINOLOGY

1. Endocrinology - Hadley.
2. General Endocrinology - Bagnara, and Turner (W.B. Saunders)
3. Endocrinology - Hadley (Prentice Hall)
4. E.J.W. Barrington - General & Comparative Endocrinology, Oxford, Clarendon Press.
5. P.J. Bentley, Comparative Vertebrate Endocrinology, Cambridge University Press.
6. R.H. Williams - Text Book of Endocrinology. W.B. Saunders.
7. C.R. Martin - Endocrine Physiology, Oxford.
8. A. Gorbman et al. Comparative Endocrinology. John Wiley & Sons

EVOLUTION

1. Introduction to Evolution - Moody (Indian Ed)
2. Evolution - Savege - (Holt, Reimhart, Winston)
3. Natural History & Evolution.Chapman & Hall. N. York
4. King M. - Species Evolution, The Role of Chromosomal change, The cam, Univ, Press.
5. Strik Berger, M.W. Evolution, Jones & Bartett. Publishers, Boston, London
6. Dobzhansky,Ayala,Stenbbins & Valentine : Evolution (WH Freeman)
7. Dobzhansky :Genetics & Origin of Species(Columbia University Press)
8. Major : Population,Species & Evolution
9. White : Animal Cytology & Evolution
10. Berrill,N.J. : The Origin Of Vertebrates
11. Colbert,E.H.:Evolution of the vertebrates
12. Romer,A.S.: Vertebrate Palaeontology(University of Chicago Press)
13. An Introduction to Palaeontology –A.P.Tyagi(S.Chand & Com.LTD)

ECOLOGY

1. Ecology - Odum (Amerind)
2. Fundamentals of Ecology - Odum - (Saunders)
3. Ecology - Ricklets (W.H. Freeman)
4. Krebs. C.J.Ecology - Harpar & Row,-N.York.
5. Krebs. C.J.Ecological methodology, Harpar & Row, N. York.

GENETICS

1. .Genetics (Mac Millan) - Strikberger
2. Genetics - Farnsworth (Harper & Raw)
3. Principles of Genetics :E.J.Gardner,M.J.Simmons & D.P.Snustand (John Wiley & Sons,INC)

BIOTECHNOLOGY

1. Principles of Gene Manipulation - An introduction to genetic engineering - R.W. Old, and S.B. Primrose.) (VCH, Publishers)
2. Molecular Biology & Biotechnology - R. A. Meyers (ed)
3. Glick : Molecular Biotechnology
4. Animal Cell Culture –A Practical Approach ,Ed.John R.W.Masters,IRL - Press

EMBRYOLOGY

1. Introduction to Embryology - Balinsky (CBS College publishers)
2. Developmental Biology - Biology - Berril, N. J. (Tata- Mc Graw Hill)
3. An outlines of Animal Development, -Davenport (Addison - Werley)
4. Biology of Developmental system - Grant
5. Developmental Biology - Subramaniyan, T (Narosa publishing House)
6. Development Biology - A Modern Sythesis, Rao, K.V. (oxford, IBM, Publishers)
7. Schatten & Schatten - Molecular Biology of Fertilization.
8. F.T.Longo - Fertilization, Chapman & Hall
9. Developmental Biology - Gilbert (Sinour)
10. Gilbert : Developmental Biology
11. Chordate Embryology : Verma & Agarwal : S.Chand & Com.LTD)

GENERAL

1. Biology - (Benzamin) Campbell Text book of Zoology,
2. Text Book of Applied Entomology - Srivastava (Kalyani Pulishers)
3. Invertebrate structure and Function - Barrington (Nelson)
4. College Zoology - Boolootin & Stiles (Mac Millan)
5. A manual of Zoology - Part - I Invertebrate -Ekambernath I Year (5. Vishwanathan)
6. Integrated Principles of Zoology - Hickman, Robert and Hickman(Timer - Mirror Mosby)
7. A life of Invertebrates - Russel - Hunter (Mac Millan)
8. .Russei - Hunter, W.D. A Biology of Higher Invertebrates.
9. Read, C.P. Animal Parasitism Prentice Hall Inc. New – Jersey

10. Gruch' G.C.-Clinical haematoiology in Medical Practice. (Eds. D. Penigton, B. Rush and P. Castai di) (1984)
11. Saidapur,S.K.: Reproductive Cycle (Allied Publishers)
12. Nalbanov,A.V.,Reproductive Physiology
13. .13. Welch : Limnology (McGraw Hill)
14. Marshall and Williams : Text book of zoology
15. Wolfe : Biology the Foundations (wadsworth)
16. Parker & Haswell : Text Book of Zoolgy Vol.I & II (Mcmillan)
17. Gee,E.P.:The Wild life of India(Collins,London)
18. Cell Biology,Genetics,Evolution & Ecology: P.S.Verma & V.K.Agarwal : S.Chand & Co.LTD)

BIO- DIVERSITY & TAXONOMY

1. M. Kato - The Biology of Bio-diversity, Springer
2. E.O.Wilson - Biodiversity, Academic Press, Washington
3. G. G. Simpson - Principles of Animal Taxonomy. Oxford IBH, Publishing Co.
4. E. Mayer. Elements of Taxonomy.
5. E.O.Wilson, The Diversity of Life (The College Edition) W. W. Northern & co.
6. B.K. Tikador - Threatened Animals of India ZSI Publicatio,Calcutta,

BIOSTATISTICS

1. Batschelet E. Introduction to Mathematics for life Scientist, Springer-Verlag Berlin.
2. Sokal, R.R. and F.J. Rohif, Biometry (Freeman)
3. Sendecor, G.W. & W. G. Cochran. Statistical Methods, Affiliated East west Press, New Delhi. (Ind. ed)
4. Murray, J. D. Mathematical Biology, Springer - Verlag, Berlin

Applied & Economic Zoology

1. Economic Zoology - Shukla & Upadhyaya (Rastogi Publishers)
2. Economic Zooiogy - VenKitaraman (Sudarsane Publishers)
3. Economic Zoology- Ahsan & Sinha (S.Chand & Company LTD)

ANIMAL BEHAVIOUR

1. Animal Behaviour, An evolutionary approach, U.S. A.
2. Glutton - Brock, T.H., The evolution of Parental Care, Princeton University Press - U.S.A.
3. Krebs, J.R. and N.B. Davis, Behavioural Ecology, Blackwell, Oxford U.K.
4. Drickamer & Vessey :Animal Behaviour, concepts, Processes and Methods (wadsworth)
5. Grier : Biology of animal Behaviour (Mosby College)
6. Animal Behaviour: Reena Mathur ,(Rastogi Publication)

IMMUNOLOGY

1. Kuby - Immunology W.H.Freeman, USA.
2. W.Paul - Fundamentals of Immunology.
3. I. M. Roitt - Essential Immunology ELBS edition. Molecular Biology: