

# **JAMSHEDPUR WOMENS COLLEGE**

## **ZOOLOGY SYLLABUS(P.G.)**

**As per CBCS system from 2017 onwards**

**Adapted from Kolhan University**

Semester	Course Code	Name Of Paper	Credit	Hrs./ Week	Full Marks	ESUE*	SIA *(For Theory) /Viva - Voce (For Practical)
<b>Semester – I</b>							
<b>I</b>	<b>FC</b>	<b>COMPUTER SCIENCE</b>	5		100	70	30
	<b>CCZOO101</b>	<b>NON CHORDATE AND CHORDATE</b>	5		100	70	30
	<b>CCZOO102</b>	<b>SYSTEMATICS , BIODIVERSITY , EVOLUTION</b>	5		100	70	30
	<b>CC(P)ZOO103</b>	<b>PRACTICAL BASED ON CZOO101 &amp; CCZOO102</b>	5		100	80	20

<b>Semester - II</b>							
<b>II</b>	<b>EC</b>	<b>RESEARCH METHODOLOGY</b>	5		100	70	30
	<b>CCZOO104</b>	<b>IMMUNOLOGY, MOLECULAR BIOLOGY &amp; COMPARATIVE ENDOCRINOLOGY</b>	5		100	70	30
	<b>CCZOO105</b>	<b>MOLECULAR CELL BIOLOGY ,CELL STRUCTURE &amp;FUNCTION</b>	5		100	70	30
	<b>PZOO106</b>	<b>PRACTICAL BASED ON CCZOO104 &amp; CCZOO105</b>	5		100	80	20

**Semester - III**

<b>III</b>	CCZOOOL 107	<b>ANIMAL BHHAVIOR , BIOTECHNOLOGY , MICROBIOLOGY</b>	5		100	70	30
	CCZOOOL 108	<b>TOOLS &amp; TECHNIQUES , BIostatISTICS AND</b>	5		100	70	30
	ECZOOOL 201A	<b>GROUP- A :- FISH AND FISHERIES</b>	5		100	70	30
	ECZOOOL 201B	<b>GROUP - B [ECOLOGY]BASIC ECOLOGY &amp; HABITAT ECOLOGY &amp; POPULATION ECOLOGY AND COMMUNITY ECOLOGY</b>			100	70	30
	EC(P)ZOOOL 202	<b>PRACTICAL BASED ON ECZOOOL 201A OR 201B</b>	5		100	80	20

**Semester - IV**

<b>IV</b>	FC	<b>BIostatISTICS</b>	5		100	70	30
	CZOOOL 109	<b>REPRODUCTIVE PHYSIOLOGY, DEVELOPMENTAL BIOLOGY &amp; GENETICS .</b>					
	ECZOOOL203A	<b>GROUP - A : FISH AND FISHERIES</b>	5		100	70	30
	ECZOOOL203B	<b>GROUP - B :[ECOLOGY] POLLUTION ECOLOGY &amp; CONSERVATION AND MANAGEMENT</b>					
	EC(P)ZOOOL 204	<b>Practical based on ECZOOOL 203A OR 203B</b>	5		100	80	20
	PROJECT ZOOOL 205	<b>Practical PROJECT</b>	5		100	80	20
<b>Total</b>			<b>80</b>				

**SYLLABUS FOR CHOICE BASED CREDIT SYSTEM**  
**M.Sc. In Zoology**  
**2<sup>nd</sup> SEMESTER**

**SEMESTER-I**  
**CZOOL - 101**  
**Non- Chordates & Chordates**

**UNIT – I :- NON – CHORDATES :-**

1. Synopsis of Diversity of Non – chordate group
2. Protozoa :- Locomotion , Reproduction
3. Origin of Metazoa
  
4. Helminths :- Parasitic adaptation
5. Annelida :- Nephridia & celomic System
6. Arthropoda :- Respiration , Excretion
7. Mollusca :- Respiration .
8. Diagnostic Characters and Distribution :-  
Rotifera , Rhychozoela , Bryozoa , Brachiopoda , Pogonophora , Sipuncula , Echiura ,  
Phoronida .

**UNIT – II CHORDATES**

1. Synopsis of Diversity of chordate groups .
2. Characteristic features and affinities of
  - **Protochordata** :- Hemichordata  
Urochordata  
Cephalochordata
3. **Fishes** :- Electric Organ and Electoreceptors
4. **Amphibia** :- Origin of Amphibia.
5. **Reptiles** :- Skull in Reptile, venom in Ophidians, Characteristic features and affinities of Sphenodon, Turtle.
  
6. **Birds** :- Parental Care in Birds, Nest building in birds .
7. **Mammals** :- Dentition, Aquatic Mammals .
8. **Comparative anatomy** :-
  - 8.1. Integument and its derivatives.
  - 8.2. Jaw suspension.

# **SEMESTER-I , CZOOL - 102**

## **SYSTEMATICS , BIODIVERSITY , EVOLUTION**

### **UNIT – I :- SYSTEMATICS & BIODIVERSITY**

1. Basic concept of taxonomy and systematic – definition and role in biology
2. Biological classification – , Type of taxonomy , Linnaean concept and modern concept of Taxonomy .
3. School of Systematic :- Numerical phonetics, cladistics , Evolutionary systematic .
  
4. Concept of Biodiversity :- Definition , significance and Ecological role, Problems and scales of biodiversity Extinction .Biodiversity in bio geographical regions ,Diversity clines in relation to area , latitude , attitude and deep sea . Biodiversity indicators, surrogate species .

### **UNIT :-II :- EVOLUTION**

1. Origin of life , Origin of cells and first organisms , evolution of eukaryotic cell from prokaryotes – a case of symbiosis .
2. Evidences of Evolution , Theories of evolution :- Lamarckism , Darwinism , Modern theories
3. Populations as a unit of Evolution :- Gene frequencies in , Mandelian population, Hardy - Weinberg equilibrium , Genetic drift.
4. Natural selection :- concept , types .  
Isolating mechanisms  
Concept of species,  
Modes of speciation .
5. Patterns of Evolution :- Micro, Macro and Mega evolution .
6. Evolution of Man :- anatomical , geographical and cultural , Ancestry of Homo sapiens .  
Evolution of Horse : - Phylogeny of history .

## **PZOOL -103, Practical Based on (CZOOL-101 & CZOOL-102)**

ITEM	MARKS DISTRIBUTION
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1. Dissection .	20
2. Spotting (10)	30

- Specimens 04
- Whole Mounts 02
- Sections 02
- Skull bones , Girdle , Limb Bones 02

3. Evolution	10
4. Ecology	10
5. Biodiversity	10
6. Practical Record	10
7. Viva Voce	10

# PZOOOL - 103 , PRACTICAL DETAILS

- **Dissections :-**

- ✓ General anatomy and nervous system of :- Leech , Prawn, Squilla , Scorpion , Unio , Pila , Sepia , Earthworm .

- **Specimen :-**

- ✓ Study of Various living invertebrate phyla along with their larva .

- **Whole Mount :-**

- ✓ Euglena , Amoeba , paramecium , Binary Fission , Conjugation in Paramecium .

- **Section :-**

- ✓ Invertebrates Species .

- **Evolution :-**

- ✓ Study of Living Fossils .
- ✓ Study of various connecting link [Peripatus , Amphioxus] .

- **Ecology :-**

- ✓ Use of ecological equipments :- plankton Net , Sedgwick rafter , Sacchi disc , PH Meter , Centrifuge , thermometer .
- ✓ Estimation of biological oxygen demand [BOD] & chemical oxygen demand [COD] .
- ✓ Sampling and identification of freshwater planktons .
- ✓ Community analysis : Estimation of relation density and relation and frequency by quadrate analysis .

- **Biodiversity :-**

1. To Submit a Project report on any related topic of animal Biodiversity .



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## **SEMESTER-II , CZOOL - 104**

### **IMMUNOLOGY & COMPARATIVE ENDOCRINOLOGY**

#### **UNIT - I , IMMUNOLOGY**

1. Vertebrate Immune System : Innate and specific /Acquired
  - 1.1 Innate Immune System : Composition , organization and structure of Lymphoid organs , cells of innate immune system and their functions , inflammation.
  - 1.2 Acquired immune system : B – cells ( types and receptors ) , T – cells ( Types and receptors ) , Antigen – Antibody interaction , Epitopes and haptens , Types , structure and functions of Antibodies , Antigen – presenting cells , Cell – Mediated and Humoral immunity.
2. MHC and their role , Self and Non – self discrimination.
3. Cytokines : Structure and function , Cytokine receptors
4. Hypersensitivity : - Type I , II , III , IV.
5. Regulation of Immune response .

#### **UNIT - II , COMPARATIVE ENDOCRINOLOGY**

1. Hormones : Classification , Mechanism of action of hormones (Receptor types and structure ) second messenger system  
cytosolic receptors and their action via gene expression .
2. Vertebrate endocrine glands and physiological role of their hormones : Adenohypophysis , Neurohypophysis, Urophysis , Thyroid , Parathyroid, corpus of stannous , Adrenal , Testes , Ovary ,Placenta , Thymus , Kidney , Heart , Liver .
3. Endocrine Hypothalamus , its hormones and their physiological role
4. Pineal gland : Melatonin and photo-periodism, biological clock .
5. Endocrinology of calcium regulation ,
6. Comparative anatomy and physiological role of hormones of
  1. Pituitary complex
  2. Adrenal gland
  3. Thyroid gland .

## **SEMESTER-II , CZOOL - 105**

### **UNIT : - I Molecular cell biology ,Cell structure & function**

1. MOLECULAR ARCHITECTURE AND PROPERTIES OF DNA :
  - 1.1 Stability and thermal denaturation
  - 1.2 Physical properties
  - 1.3 Types of DNA
  - 1.4 Denaturation and renaturation of DNA.
  
2. DNA replication:
  - 2.1 Enzymes and accessory proteins involved in replication
  - 2.2 Mechanism of DNA replication in Prokaryotes and Eukaryotes.
  
3. Transcription and Post – transcriptional events :
  - 3.1 RNA polymerases in Prokaryotes and Eukaryotes , Transcription factors.
  - 3.2 Mechanism of transcription in Prokaryotes and Eukaryotes :- Assembly of pre-initiation complex and initiation , elongation and termination.
  - 3.3 Post – transcription modifications in RNA : 5' – cap formation , 3' end processing and poly adenylation , RNA splicing , RNA editing , Post – transcriptional gene silencing ( RNA interference ) , Catalytic RNA and it's role , Nuclear export of mRNA.
  
4. Translation
  - 4.1 Prokaryotic and Eukaryotic translation : Mechanism of initiation , elongation and termination.
  - 4.2 Post – translational modifications of proteins.
  
5. Regulation of Gene expression
  - 5.1 Regulation of Gene expression in Prokaryotes : Operon concept , Inducible and repressible system , Positive and Negative control , Enhancers and silencers , Tryptophan – Operon , Lac – Operon ,
  - 5.2 Regulation of Gene expression in Eukaryotes.

## UNIT :- II CELL STRUCTURE AND FUNCTION

### 1. Cell membrane

1. 1 Structure :- Model cell membrane structure , lipid bilayer , Membrane proteins .

1. 2 Transport across cell membrane :- channels , carriers , pumps ,  
mechanism of diffusion.

### 2. Sorting of Proteins

2. 1 Signal peptide and SRP –dependent targeting of translational complex

2. 2 Processing of proteins in RER

2. 3 Processing through Golgi complex, targeting to plasma membrane & Lysosome

2.4 Structure and biogenesis of Ribosomes

### 3. Nucleolus :- Structure and Function

4. Cytoskeleton :- Organization of Microtubules , microfilaments and Intermediate filaments ,role of cytoskeleton elements In cell shape , motility and cell division .

### 5. Cell signalling and Intercellular junctions

5. 1 Intercellular junctions , extracellular matrix , cell-cell adhesion, gap junction .

5. 2 Receptor classes :- Membrane receptors , Intracellular receptors

### 6. Cell Cycle :-

6. 1 Cell cycle and it's regulation :- role of cyclins and cdks . checkpoints in mammalian cell cycle .

6. 2 Apoptosis :- Mechanism and significance

**PZOOL - 106 , PRACTICAL**  
**PZOOL - 106 , Practical Based on (CZOOL-104 & CZOOL-105)**

ITEM	MARKS DISTRIBUTION
1. Dissection .	20
2. Spotting (10)	30
• Endocrinology Slides	02
• Developmental Biology Slides	02
• Microbial Slides	02
• Protochordates & Vertebrates Specimens	02
• Bones (Skull bones , Girdle , Limbs bones )	02
3. Hematology	10
4. Cell Biology	10
5. Physiology & Biochemistry	10
6. Quantitative Biology	05
7. Sessional Work	10
8. Viva - Voce	05

## **PZOOOL - 106 , PRACTICAL DETAILS**

### **1. Dissection :-**

- Afferent & efferent branchial vessels of bony fish.
- Accessory respiratory organ of air breathing fish .
- Neck nerves of mammals .

### **2. Hematology :-**

- Preparation and study of various blood corpuscles of vertebrates .
- Determination of Hb % , ESR , TC DC , haematocrit value , PCV of blood of any vertebrate in normal and experimental condition .

### **3. Cell Biology :-**

- Study of meiotic stages from temporary Acetocarmine aquash preparation of Grass Hopper Testis .
- Study of salivary gland polytene chromosomes from temporary acetocarmine aquash preparation .

### **4. Physiology & Biochemistry :-**

- Measurement of arterial blood pressure in man with help of of sphygmomanometer by Auscultation method .
- Estimation of glucose , cholesterol , lipid in the serum of any mammals .

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## **SEMESTER-III, CZOOL - 107**

### **ANIMAL BEHAVIOR, BIOTECHNOLOGY , MICROBIOLOGY**

#### **UNIT :- I , ANIMAL BEHAVIOR**

1. Animal Behaviour :- Definition , objectives , significance . Patterns of behaviour :- Innate and Learned behaviour , concept of FAP, concept of Key or sign stimulus , innate releasing Mechanism , concept of Learning , imprinting , concept of evolution of behaviour .

2. Orientation in Animals :- Kinesis ,Types of Kinesis , Taxis Types of taxis Echolocation ,Language of honey bees .

3. Biological rhythms: - occurrence and significance , circadian , circannual , circatidan ,circalunar , circasyzygie Clocks (with examples) .

4. Social behaviour in insects .

#### **UNIT :- II MICROBIOLOGY .**

1. Microbial nutrition , growth and control : -

1.1.Micobial growth : Prokaryotic cell cycle, Growth curve, measurement of microbial growth , Influence of of Environmental factors on growth .

1.2. Control of microbial growth : Pattern of microbial death, Use of physical methods and chemical agents In control .

2. Viruses :

2.1. General characteristics of viruses, structure of Viruses , TMV, Bacteriophages

2.2. Virus reproduction, cultivation of virus , virus purification and Assays .

2.3. Viroids , virusoids, Prions

2.4. Viruses and cancer

3. HIV : Structure , mode of infection, AIDS .

4. Common Antibiotics and their mode of action, vaccines ,

5. Applied and Industries microbiology :



## UNIT : III :- BIOTECHNOLOGY

1. Basic steps in Gene cloning , Enzyme used for gene cloning .

2. Vectors :-

2.1 Definition , characteristics , types :- cloning and expression vectors.

2.2 Bacterial Plasmids as vectors , pBR322 , pUC , Cosmids , phagmids , Binary vectors , BAC , YAC , MAC.

2.3 Selection of recombinants.

3. Gene Libraries

3.1 Genomic library and CDNA library : Construction and applications.

4. Methods' of introduction of cloned genes into host cells.

5. Applications of Biotechnology :

5.1 Preparation of Transgenic cell and animals : mechanism and applications.

5.2 Mechanism of production of Growth hormone , Insulin , Interferon's.

5.3 Mono clonal antibodies and Hybridoma technology

5.4 Gene therapy, Recombinant Vectors.

6. PCR : Mechanism and application

# SEMESTER-III, CZOOL - 108

## TOOLS & TECHNIQUES , BIOSTATISTICS

### UNIT :- I , TOOLS AND TECHNIQUES :-

1. Microscopy : ( Working Principle & methods of application )
  - 1.1 Fluorescence microscopy
  - 1.2 SEM
  - 1.3 TEM
2. Spectrophotometry
  - 1.1 Types of Spectrophotometer
  - 1.3 Absorption spectrum
3. Electrophoresis :
  - 3.1 Principle & applications.
  - 3.2 Agarose – and PAGE
4. Chromatography :-
  - 4.1 Principle & Applications
  - 4.2 Paper and thin layer chromatography
  - 4.3 Column chromatography :- Gel filtration , Ion exchange , Affinity chromatography
  - 4.4 HPLC
5. Immunological Technique :-
5. NMR and X- RAY crystallography
  - 5.1. MRI , 5.2. RIA, ELISA
6. Centrifugation :-\_ Basic principles, types , application

### UNIT :- II ,BIOSTATISTICS

1. INTRODUCTION TO BIOSTATISTICS :- Population , sample variable , parameter , primary and secondary data , screening and representation of data , frequency distribution , bar diagram , histogram , pie diagram.
2. Mean , Median , Mode , standard deviation , Variance , Co – efficient of variation ANOVA ( One – way and two – way ).
3. Correlation and Regression
4. Hypothesis testing :- Non – parametric and parametric tests ,  $\chi^2$  – test , t – test , F – test.

**SEMESTER-III, Elective Course - 201A**  
**[GROUP - A]**  
**FISH AND FISHERIES**

UNIT :- 1

A- EVOLUTION OF FISHES

- origin and evolution of fishes
- Classification of fishes up to order
- Evolution and phylogeny of fishes.

B SPECIAL ORGANS

- Fish osteology
- Acoustic- Lateralis system
- Accessory respiratory organs

C FISH PHYSIOLOGY

- Excretion and Osmoregulation in fishes
- Reproductive System – histology of ovary , ovarian cycle in teleosts
- Osmoregulation in fishes

D FISH ADAPTATION

- Migration – general accounts , migration behavior of some fishes, factor influencing fish migration and advantage of migration
- Deep sea and hill streams fishes
- Air bladder and weberian apparatus

## UNIT :- 2

### A - FISH CULTURE

- Physico-Chemical and biological factors in fishes
- Fish culture in fresh water fishes
- Fish culture programming

### B- MARINE FISERIES OF INDIA

- Stratification of marine habitat, group of marine fisheries
- Coastal fisheries of India
- Fisheries of Bombay duck ,ribbon fish , pomfrets and Prawn

### C- ESTUARINE FISHERIES

- Definition ,origin and classification
- Estuarine fisheries of Chilka Lake
- Prawn culture

### D- RIVERINE FISHERY OF INDIA

- Fisheries of Ganga river system
- Dams and their effects on fish migration

**ECZOOLOGY - 202A, PRACTICAL ,  
ECZOOLOGY - 202 , Practical Based on (PAPER - ECZOOLOGY -201A)  
[GROUP - A]**

<b>ITEMS</b>	<b>MARKS</b>
<b>1. Dissection</b>	<b>20</b>
<b>2. Taxonomic Description</b>	<b>10</b>
<b>3. Spotting (10 spots)</b>	<b>30</b>
<b>3 Slides</b>	
<b>2 Bones</b>	
<b>3 Fishes</b> (food fishes ,ornamental ,larvicidal , exotic fishes and Fishes with adaptive features)	
<b>1 Fishing / ecological equipments</b>	
<b>1 Plankton / aquatic weeds or plants</b>	
<b>4. Adaptation / plankton</b>	<b>05</b>
<b>5. Genetics</b>	<b>10</b>
<b>6. viva - voce</b>	<b>10</b>
<b>7. Records and Sessional Work</b>	<b>15</b>

# **PZOOOL - 202A , PRACTICAL DETAILS**

## **1. Dissection :-**

- > general anatomy , Cranial nerves, Afferent and efferent blood vessels of fishes.
- > Digestive system of herbivore and carnivore fishes

## **2. Taxonomic Description :-**

- > taxonomic identification up to species of important fresh water and marine fishes

## **3. Adaptation / plankton :-**

- > Collection identification of aquatic plants , weeds & plankton .

## **4. Genetics :-**

- > Localization of RNA / DNA in prefixed tissue by didderent staining . e.g methyl green - pyronin Y .
- > Fuelgens reaction to locate DNA .
- > Quantative estimation of DNA and RNA is biological . Sample by Spectrophotometer .
- > C- banding , NOR - banding , sister chromatid exchanges in bone marrow chromosome preparation .
- > Drosophila or chironomus larva salivary gland chromosomes .

## SEMESTER-III, Elective Course - 201B

### [GROUP - B] , ECOLOGY

#### BASIC ECOLOGY & HABITAT ECOLOGY & POPULATION ECOLOGY AND COMMUNITY ECOLOGY

#### UNIT - I , BASIC ECOLOGY & HABITAT ECOLOGY

##### 1 : Basic Ecology

- 1.1. Productivity : primary ,secondary and tertiary .
- 1.2. ecological niche : niche overlap and niche breath ,niche segregation.

##### 2 : Fresh water Ecology

- 2.1. Origin and classification of lakes .
- 2.2. Physic - chemical and biological (plankton and Benthos ) characteristics of lakes .

##### 3 : Terrestrial Ecology

- 3.1. Characteristics of desert and forest biomass (with particular reference to india).
- 3.2. Adaptation of desert animals .

#### UNIT - II

#### POPULATION ECOLOGY AND COMMUNITY ECOLOGY

##### 4. Population Growth

- 4.1. Exponential
- 4.2. Sigmoid
- 4.3. Stochastic model for growth .

##### 5. Population interaction

- 5.1. Competition - types ,intra & inter specific competition , Competitive ability .
- 5.2. Lotka - volterra models for competing species .
- 5.3. Predation - predatory response , co evolution of prey predator system one prey one predator model .

##### 6. Natural regulation of population

- 6.1. Theories
- 6.2. Role of density dependent and density independent factors .
- 6.3. Model for population regulation

##### 7. Community Ecology

- 7.1. Commu nity structure
- 7.2. Concept of ecological dominance .
- 7.3. Concept of species diversity .
- 7.4. Ecotype and ecotone , concept of climax .

**ECZOOLOGY - 202B, PRACTICAL ,  
ECZOOLOGY - 202B , Practical Based on (PAPER - ECZOOLOGY -201B)  
[GROUP - B]**

<b>ITEMS</b>	<b>MARKS DISTRIBUTION</b>
1. Water Analysis	20
2. Biotic Analysis	15
3. Bio Statistical Analysis	15
4. Adaptation study Spotting [5x4]	20
5. Record and Sessional Work	20
6. Viva - Voce	10



# **ECZOOLOGY - 202B, PRACTICAL DETAILS**

## **1. WATER ANALYSIS :-**

- Estimation of carbonate , and Dissolved  $O_2$  &  $CO_2$  in sample water .
- Estimation of chloride in sample water .
- Estimation of hardness & OMC of Sample water .
- Estimation of Magnesium and calcium in sample water

## **2. BIOTIC ANALYSIS :-**

- Qualitative , Quantitative assessment and working of indices of diversity and dominance of :-
  - ✓ Plankton .

## **3. BIostatistical ANALYSIS :-**

- Analysis of correlation coefficient and simple linear regression in set of data .
- Analysis of similarity index in the species composition by 2x2 contingency table in a forest system .

## **4. ECOLOGICAL ADAPTATION STUDY :-**

- Aquatic insect , Terrestrial insects .
- Higher Vertebrates .
- Ecological Equipments .
- Ecological significances of earthworm .
- Identification of Aquatic plants and weeds .

**SYLLABUS FOR CHOICE BASED CREDIT SYSTEM**  
**M.Sc. In Zoology**  
**4rth SEMESTER**

## SEMESTER-IV, CZOOL - 109

### REPRODUCTIVE PHYSIOLOGY ,DEVELOPMENTAL BIOLOGY & GENETICS .

#### UNIT :- I , REPRODUCTIVE PHYSIOLOGY , DEVELOPMENTAL BIOLOGY.

1. Sperm maturation in Male reproductive tract , role of testicular hormones , capacitation in female reproductive tract.
2. Bizarre phenomena in mammalian reproduction : Bruce effect , Lee boot effect , Whitten effect.
3. Uterine cycles : - Estrus and menstrual cycle , hormonal regulation of uterine cycles
4. Implantation , Delayed implantation , sterility due to hormonal defects , IVF , Super Ovulation , Variations in IVF.
5. Early Embryonic development :
  - 6.1 cleavage and blastulation , characteristics of cleavage , physiology of cleavage.
  - 6.2 Fate maps and cell linkage
  - 6.3 Gastrulation , morphogenetic movements , Neurulation : neurogenesis , notogenesis and mesogenesis, Morphogenesis.
6. Differentiation: Cell commitment , determination and cyto differentiation , molecular biology of differentiation , control , levels of differentiation , tissue maintenance and replacement.
7. Blastogenesis , Regeneration ( Morphalaxis and Epimorphosis ) , Regeneration of amphibian limb and lens.
8. Metamorphosis : Hormonal regulation of amphibian metamorphosis.
9. Stem cells and their applications.

#### UNIT :- II , GENETICS .

1. Mendel's laws and their chromosomal basis , Extension of Mendelism : Epistasis , Pleiotropy , multiple allelism , Linkage.
2. Gene mutation and DNA repair :
  - 2.1 Types of gene mutations.
  - 2.2 Methods for detection of induced mutations.
  - 2.3 P – element insertional mutagenesis in Drosophila
  - 2.4 DNA damage and repair
3. Methods of gene mapping :
  - 3.1 3 – point test cross in Drosophila
  - 3.2 Gene mapping in human by linkage analysis in pedigrees.
  - 3.3 Tetrad analysis in Neurospora
  - 3.4 Gene mapping in bacteria by conjugation , transformation and transduction.
4. Organization and function of mitochondrial DNA :

**SEMESTER-IV , Elective Course - 203A**  
**[GROUP - A]**

**FISH AND FISHERIES**

**UNIT :- 1**

**A- AQUATIC WEEDS AND AQUATIC POLLUTION**

- Introduction and classification of aquatic weeds .
- Common aquatic weeds and control measures

**B- FISH PRESERVATION**

- Method of fish preservation
- Reasons for spoilage of fishes
- Fish By-Product

**C- SEWAGE FEED FISHERIES**

- Definition Sewage ,general account, and quality of sewage
- Treatment of sewage, principle cultivation fishes
- Production of sewage fish culture

**D- INDUCE BREEDING**

- Bundh breeding, types of Bundhs
- Induced Breeding by Hypophysaton
- Factors influencing induced breeding

**UNIT 2**

**A- FISH PATHOLOGY AND CURE**

- Nutritional Diseases
- Intrinsic diseases
- diseases caused by pathogens and parasites and their treatment

**B-SPECIALIZED ORGANS IN FISHES**

- Light producing organs
- Electric organs in fishes
- Sound producing organs
- Poison glands in fishes

**C-ENDOCRINE GLANDS**

- Pituitary gland or hypophysis
- Corpuscles of Stannius
- Ultimobranchial Glands

**E- FISHING GEARS**

- Local fish catching device
- Conventional inland and marine fishing gears
- Modern fish catching device and techniques

**ECZOOLOGY - 204A, PRACTICAL**  
**Practical Based on (PAPER - ECZOOLOGY -203A)**  
**[GROUP - A]**

<b>ITEMS</b>	<b>MARKS</b>
<b>1. Microtomy</b>	<b>20</b>
<b>2. Spotting (10 spots)</b>	<b>30</b>
3 slides from fish Endocrinology . 3 slides from developmental biology . 1 specimen showing animal behaviour. 2 slides from Reproductive system . 1 Microbial slide .	
<b>3. Reproductive Techniques</b>	<b>10</b>
<b>4. Immunology</b>	<b>10</b>
<b>5. Sessional Work</b>	<b>20</b>
<b>6. Viva - voce</b>	<b>10</b>

# **ECZOOLOGY - 204A, PRACTICAL DETAILS**

## **1. Microtomy:-**

- Study of the histological and histochemical slides of different organs of vertebrates .
- Fixative , staining and preparation of histological & endocrinological slides of different organs of fish .

## **2. Reproductive Techniques :-**

- Collection of mammalian blastocyst .
- Ovariectomy /orchidectomy in mice/rat .
- Dating of uterine cycle in vaginal smears of any mammal .

## **3. Immunology :-**

- Blood film preparation and identification of cells .
- Antigen antibody interaction in vitro .
- Histology of lymphoid organs .
- Immunological diagnosis of pregnancy by ELISA .

**SEMESTER-IV , Elective Course - 203B**  
**[GROUP - B] , ECOLOGY**  
**POLLUTION ECOLOGY & CONSERVATION AND MANAGEMENT**

**UNIT - I , POLLUTION ECOLOGY**

**1. Water Pollution .**

- 1.1. Types and source pollutants and their effect .
- 1.2. Eutrophication .
- 1.3. Biodegradable and non - degradable pollutants .
- 1.4. Bio - indicators of pollution .

**2. Air pollution**

- 2.1. Sources and effect of air pollutants
- 2.2. Aerosol , Smog .
- 2.3. Green house effect
- 2.4. Ozone depletion.
- 2.5. Acid rain

**3. Eco-toxicology**

- 3.1. Effect of agriculture waste , heavy metals , organic wastes and industrial wastes on aquatic organisms.
- 3.2. Biomagnifications

**UNIT - II , CONSERVATION AND MANAGEMENT**

**4. Conservation & Biodiversity**

- 4.1. Concept of conservation
- 4.2. Conservation of natural resources & their importance .
- 4.3. Concept of biodiversity .
- 4.4. Causes of biodiversity depletion .
- 4.5. Hot spots and mega biodiversity zones .
- 4.6. Priority fixation of biodiversity conservation.

**5. Resource management**

- 5.1. Concept of natural resources.
- 5.2. Management of air & water resources.

**6. Wildlife and forest Management**

- 6.1. Concept of endangered , Critically endangered species , endangered species , Vulnerable & Rare Species.
- 6.2. Importance of wild life and causes of Extinction .
- 6.3. Biological basis of wild life management .

**7. Environmental biotechnology**

- 7.1. Concept of bioremediation and its application.
- 7.2. Solid waste management: both organic and inorganic.

**ECZOOLOGY - 204B, PRACTICAL**  
**Practical Based on (PAPER - ECZOOLOGY -203B)**

<b>ITEMS</b>	<b>MARKS DISTRIBUTION</b>
1. Soil Analysis	20
2. Biotic Analysis	15
3. Bio Statistical Analysis	15
4. Adaptation study Spotting [5x4]	20
5. Record and Sessional Work	20
6. Viva - Voce	10



# **ECZOOLOGY - 204B, PRACTICAL DETAIL**

## **1. SOIL ANALYSIS :-**

- Estimation of OMC / Total carbon of soil sample .
- Estimation of  $\text{CaCO}_3$  in a soil sample .
- Estimation of soil respiration rate in a sample .
- Estimation of N,P,K, in a soil sample .
- Oxidation value of leaf of a plant in a chosen system.

## **2. BIOTIC ANALYSIS :-**

- Qualitative , Quantitative assessment and working of indices of diversity and dominance of :-
  - ✓ Benthos .
  - ✓ Soil fauna.

## **3. BIostatistical ANALYSIS :-**

- Analysis of standard deviation and standard error in a set of data .
- Species area curve for sampling of population by quadrat method.

## **4. ECOLOGICAL ADAPTATION STUDY :-**

- Fresh water fish [hill stream fish]
- Marine fish .
- Ecological Equipments (use of pH meter, water bath, centrifuge, colorimeter, thermometer) .
- Ecological significances of plants .
- Identification of Bio indicator Species .



## **SEMESTER-IV, PROJECT WORK**

**PZOOL - 110**

**Practical hrs :- 30**

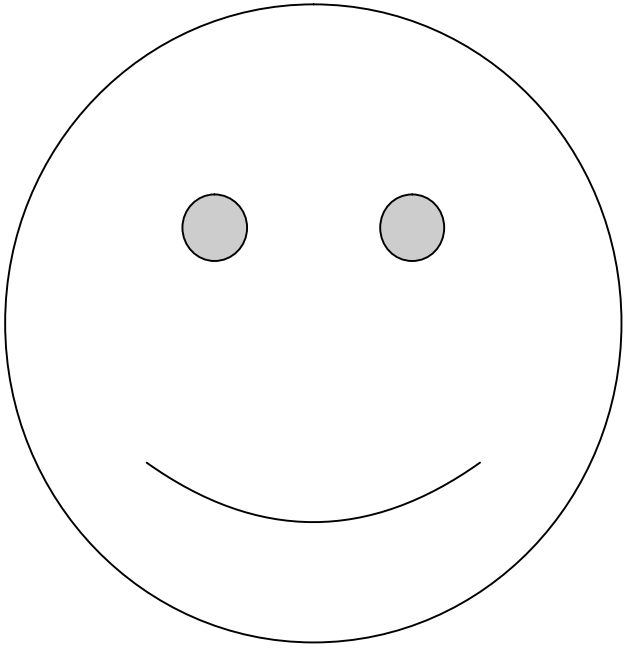
### **Project work**

The objective of this paper is to inculcate the trait of independent investigation , the student shall work (approximately 60 to 75 study hours ) on some topic related to his / her area of specialization or related to his / her broader area of study . He / she shall write a project report preferably independently or in association with faculty members of the Department /Research institutes recognized by Kolhan University.

Two examiners shall evaluate the project. a written test one hour duration relating to the project shall be taken .

### **MARKS DISTRIBUTION**

❖ Project Preparation through Power Point	40
❖ Written Test	40
❖ Viva - Voce	20



**END**  
**THANK...U**

