Kolhan university

CHAIBASA

UNIVERSITY DEPARTMENT OF ZOOLOGY, KOLHAN UNIVERSITY , CHAIBASA

COURSE CURRICULUM FOR POSTGRADUATE COURSES UNDER CHOICE BASED CREDIT SYSTEM

M.Sc .Zoology

WITH EFFECT FROM 2017

Dr. S.B.Lal [HOD]
CHAIRPERSON

Dr. Uday Singh .R.U
Prof.S.S.Razi
Dr.K.K.Sharma
Dr.Ravinder Singh
Dr. Anjali Srivastava
Dr. A.P.V.Khalko

Semester	Course Code	Name Of Paper	Credit	Hrs./ Week	Full Marks	ESUE*	SIA *(For Theory) /Viva - Voce (For Practical)

Semester - I

I	FC	COMPUTER SCIENCE	5		100	70	30
	CCZOOL101	NON CHORDATE AND CHORDATE	5		100	70	30
	CCZOOL102	SYSTEMATICS , BIODIVERSITY , EVOLUTION	5		100	70	30
	CC(P)ZOOL 103	PRACTICAL BASED ON CZOOL 101 & CCZOOL 102	5		100	80	20

Semester - II

II	EC	RESEARCH METHODOLOGY	5		100	70	30
	CCZOOL104	IMMUNOLOGY, MOLECULAR BIOLOGY & COMPARATIVE ENDOCRINOLOGY	5		100	70	30
	CCZOOL 105	MOLECULAR CELL BIOLOGY ,CELL STRUCTURE &FUNCTION	5		100	70	30
	PZOOL 106	PRACTICAL BASED ON CCZOOL 104 & CCZOOL 105	5		100	80	20

Semester - III

III	CCZOOL 107	**ANIMAL BHHAVIOR , BIOTECHNOLOGY , MICROBIOLOGY**	5		100	70	30
	CCZOOL 108	**TOOLS & TECHINIQUES , BIOSTATISTICS AND**	5		100	70	30
	ECZOOL 201A	**GROUP- A :- FISH AND FISHERIES**	5		100 100	70 70	30 30
	ECZOOL 201B	**GROUP - B [ECOLOGY]BASIC ECOLOGY & HABITAT ECOLOGY & POPULATION ECOLOGY AND COMMUNITY ECOLOGY**					
	EC(P)ZOOL 202	**PRACTICAL BASED ON ECZOOL 201A OR 201B**	5		100	80	20

Semester - IV

IV	FC	**BIOSTATICS**	5		100	70	30
	CZOOL 109	**REPRODUCTIVE PHYSIOLOGY, DEVELOPMENTAL BIOLOGY & GENETICS .**					
	ECZOOL203A	**GROUP - A : FISH AND FISHERIES**	5		100	70	30
	ECZOOL203B	**GROUP - B :[ECOLOGY] POLLUTION ECOLOGY & CONSERVATION AND MANAGEMENT**					
	EC(P)ZOOL 204	**Practical based on ECZOOL 203A OR 203B**	5		100	80	20
	PROJECT ZOOL 205	**Practical PROJECT**	5		100	80	20
		Total	**80**				

SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

M.Sc. In Zoology

1ST 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 Disstribution :-
   Rotifera , Rhychocoela , Bryozoa , Brachiopoda , Pogonophora , Sipuncula , Echiura , Phoronida .

UNIT – II CHORDATES

1. Synopsis of Diversity of chordate groups .
2. Charateristic features and affinities of
   - **Protochordata** :- Hemichordata
     Urochordata
     Cephalochordata
3. **Fishes** :- Electric Organ and Electrorecepters
4. **Amphibia** :- Origin of Amphibia.
5. **Reptiles** :- Skull in Reptile, venom in Ophidians, Characteristic features and affinities of Sphenoden, 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

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

ITEM	MARKS DISTRIBUTION
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

PZOOL - 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 , Binnary 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 .**

SYLLABUS FOR CHOICE BASED CREDIT SYSTEM
M.Sc. In Zoology
2nd SEMESTER

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 polymersases 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. Quantative Biology	05
7. Sessional Work	10
8. Viva - Voce	05

PZOOL - 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 .**

SYLLABUS FOR CHOICE BASED CREDIT SYSTEM
M.Sc. In Zoology
3rd SEMESTER

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 & TECHINIQUES , 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. Chromatatography :-
   4.1 Principle & Applications
   4.2 Paper and thin layer chromatography
   4.3 Column chromatography :- Gel filtration , Ion exchange , Affinity chromatography
   4.4 HPLC

   Immunological Technique :-
5. NMR and X- RAY crystallography

   5.1. MRI , 5.2. RIA, ELISA

6. Centrifugation :- Basic principles, types , application

UNIT :- II ,BIOSTATICS

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 , x^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

ECZOOL - 202A, PRACTICAL ,

ECZOOL - 202 , Practical Based on (PAPER - ECZOOL -201A)

[GROUP - A]

ITEMS	MARKS
1. Dissection	20
2. Taxonomic Description	10
3. Spotting (10 spots)	30

- 3 Slides
- 2 Bones
- 3 Fishes (food fishes ,ornamental ,larvicidal , exotic fishes and Fishes with adaptive features)
- 1 Fishing / ecological equipments
- 1 Plankton / aquatic weeds or plants

4. Adaptation / plankton	05
5. Genetics	10
6. viva - voce	10
7. Records and Sessional Work	15

PZOOL - 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 ninche : niche overlap and ninche breath ,ninhe 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 .

ECZOOL - 202B, PRACTICAL ,

ECZOOL - 202B , Practical Based on (PAPER - ECZOOL -201B)

[GROUP - B]

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

ECZOOL - 202B, PRACTICAL DETAILS

1. WATER ANALYSIS :-

- **Estimation of carbonate , and Dissolved o_2 & Co_2 in sample water .**
- **Estimation os chloride in sample water .**
- **Estimation of hardnss & OMC of Sample water .**
- **Estimation of Magnesium and calciumin sample water**

2. BIOTIC ANALYSIS :-

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

3.BIOSTATISTICAL ANALYSIS :-

- **Analysis of correlation co efficient and sample 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 harmones , capacitation in female reproductive tract.
2. Bizzarre 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 Epimorbhosos) , Regeneration of amphibian limb and lens.
8. Metamorphosis : Harmonal regulation of amphibian metamorphosis.
9. Stem cells and their applications.

UNIT :- II , GENETICS .

1. Mendel's laws and their chromosomal basis , Extension of Mendelism : Epist asis , 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. Medhods 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 sewge, 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

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

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

ECZOOL - 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 .**
- **Ovariectory /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 , Valnerable & 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.

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

ITEMS	MARKS DISTRIBUTION
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

ECZOOL - 204B, PRACTICAL DETAIL

1. SOIL ANALYSIS :-

- **Estimation of OMC / Total carbon of soil sample .**
- **Estimation of $CaCo_3$in a soil sample .**
- **Estimation of soil respiration rate in a sample .**
- **Estimation of N,P,K, in a soil sample .**
- **Oxyclorific 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 devation and standed error in a set of data .**
- **Species area curve for sampling of population by quadrate 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

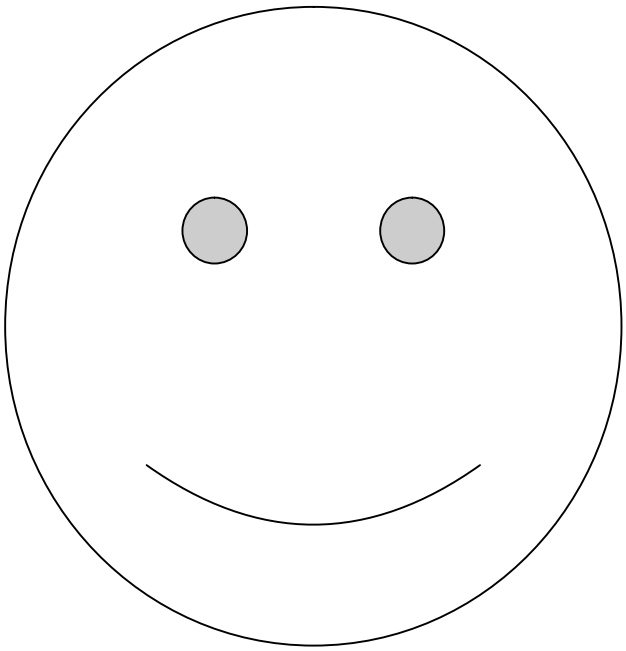
Project work

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