

# ADIKAVI NANNAYA UNIVERSITY

## RAJAMAHENDRAVARAM

### CBCS / Semester System

(W.e.f. 2016-17 Admitted Batch)

#### I Semester Syllabus

#### ZOOLOGY

#### ANIMAL DIVERSITY - NONCHORDATES

**Periods:60**

**Max. Marks:100**

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#### Unit - I

#### 1.1 Brief history, Significance of Diversity of Non Chordates

#### 1.2 Protozoa

##### 1.2.1 General characters

##### 1.2.2 Classification of Protozoa up to classes with examples

##### 1.2.3 *Elphidium* (type study)

#### 1.3 Porifera

##### 1.3.1 General characters

##### 1.3.2 Classification of Porifera up to classes with examples

##### 1.3.3 *Sycon* – External Characters, Types of cells,

##### 1.3.4 Skelton in Sponges

##### 1.3.5 Canal system in sponges

#### Unit - II

#### 2.1 Coelenterata

##### 2.1.1 General characters

##### 2.1.2 Classification of Coelenterata up to classes with examples

##### 2.1.3 *Obelia* - External Characters, Structure of Polyp and Medusa

##### 2.1.4 Polymorphism in coelenterates

##### 2.1.5 Corals and coral reef formation

#### 2.2 Platyhelminthes

##### 2.1.1 General characters

##### 2.1.2 Classification of Platyhelminthes upto classes with examples

##### 2.1.3 *Fasciola hepatica* - External Characters, Excretory system, Reproductive System, Life History and pathogenicity

#### Unit - III

#### 3.1 Nemathelminthes

##### 3.1.1 General characters

##### 3.1.2 Classification of Nemathelminthes up to classes with examples

#### 3.2 Annelida

##### 3.2.1 General characters

##### 3.2.2 Classification of Annelida up to classes with examples

##### 3.2.3 *Hirudinaria granulosa* - External Characters, Digestive System, Excretory System and Reproductive System

3.2.4 Coelomoducts

3.2.5 Vermiculture - Scope, significance, earthworm species, processing, Vermicompost, economic importance of vermicompost

#### **Unit - IV**

4.1 Arthropoda

4.1.1 General characters

4.1.2 Classification of Arthropoda up to classes with examples

4.1.3 Prawn - External Characters, Appendages, Respiratory system and Circulatory System

4.1.4 *Peripatus* - Structure and affinities

4.2 Mollusca

4.2.1 General characters

4.2.2 Classification of Mollusca up to classes with examples

4.2.3 Pearl formation in Pelecypoda

4.2.4 Torsion in gastropods

#### **Unit - V**

5.1 Echinodermata

5.1.1 General characters

5.1.2 Classification of Echinodermata up to classes with examples

5.1.3 Water vascular system in star fish

5.2 Hemichordata

5.2.1 General characters

5.2.2 Classification of Hemichordata up to classes with examples

5.2.3 *Balanoglossus* - Structure and affinities

5.3 Non-Chordata larval forms

5.3.1 Amphiblastula

5.3.2 Ephyra

5.3.3 Trochophore

5.3.4 Nauplius

5.3.5 Glochidium

5.3.6 Bipinnaria

5.3.7 Tornaria

## ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER

### ZOOLOGY - PAPER - I ANIMAL DIVERSITY - NONCHORDATES

Periods: 24

Max. Marks: 50

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#### Observation of the following slides / spotters / models

- Protozoa** : *Elphidium, Paramecium* - Binary fission and conjugation
- Porifera** : *Spoonbill, Euspongia, Sycon, Sycon* - T.S and L.S
- Coelenterata** : *Obelia* - colony and medusa, *Physalia, Velella, Corallium, Gorgonia, Pennatula*
- Platyhelminthes** : *Planaria, Fasciola hepatica, Fasciola* larval forms - Miracidium, Redia, Cercaria, *Echinococcus granulosus*
- Nemathelminthes** : *Ascaris* - Male and female, *Ancylostoma duodenale*
- Annelida** : *Neries, Heteroneries, Aphrodite, Hirudo*, Trochophore larva
- Arthropoda** : Mouth parts of male and female *Anopheles* and *Culex*, Mouth parts of housefly, Mouth parts of Scorpion, Nauplius, Mysis, Zoa larvae, crab, prawn, *Scolopendra, Sacculina, Limulus, Peripatus*
- Mollusca** : *Chiton, Murex, Sepia, Loligo, Octopus, Nautilus*, Glochidium larva
- Echinodermata** : *Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Asterias*, Bipinnaria larva
- Hemichordata** : *Balanoglossus*, Tornaria larva

#### Demonstration of dissection / dissected / virtual dissection :

1. Leech / Prawn / Scorpion / Crab - Digestive system
2. Prawn - Appendages
3. Prawn / Scorpion / Crab - Nervous system
4. *Pila / Unio* - Digestive system
5. Mounting of Statocyst
6. Mounting of Radula

**b Laboratory record work shall be submitted at the time of practical examination**

**b Compulsory one species to be adopted for demonstration only by the faculty**

**b Computer aided techniques should be adopted as per UGC guide lines**



**ADIKAVI NANNAYA UNIVERSITY**  
**CBCS/SEMESTER SYSTEM**  
**SEMESTER II: B.Sc ZOOLOGY**  
(FOR 2016-17 ADMITED BATCH)

**ANIMAL DIVERSITY - CHORDATES**

**Periods:60**

**Max. Marks: 100**

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**Unit - I**

**1.1 General characters of Chordata**

**1.2 Prochordata**

- 1.2.1 Salient features of Cephalochordata
- 1.2.2 Structure of *Branchiostoma*
- 1.2.3 Affinities of Cephalochordata
- 1.2.4 Salient features of Urochordata
- 1.2.5 Structure and life history of *Herdmania*
- 1.2.6 Significance of Retrogressive metamorphosis

**Unit - II**

**2.1 Cyclostomata**

- 2.1.1 General characters of Cyclostomata
- 2.1.2 Comparison of the *Petromyzon* and *Myxine*

**2.2 Pisces**

- 2.2.1 General characters of Fishes
- 2.2.2 Classification of fishes up to sub - class level with examples
- 2.2.3 *Scoliodon* - External features, Digestive system, Respiratory system, Heart, Brain
- 2.2.4 Migration in Fishes
- 2.2.5 Types of Scales
- 2.2.6 Dipnoi

**Unit - III**

**3.1 Amphibia**

- 3.1.1 General characters of Amphibian
- 3.1.2 Classification of Amphibia upto orders with examples.
- 3.1.3 *Rana hexadactyla* - External features, Digestive system, Respiratory system, Heart,

Brain

**3.2 Reptilia**

- 3.2.1 General characters of Reptilia
- 3.2.2 Classification of Reptilia upto orders with examples
- 3.2.3 Calotes - External features, Digestive system, Respiratory system, Heart, Brain
- 3.2.4 Identification of Poisonous snakes and Skull in reptiles

## **Unit - IV**

### **4.1 Aves**

4.1.1 General characters of Aves

4.1.2 Classification of Aves upto subclasses with examples.

4.1.3 *Columba livia* - External features, Digestive system, Respiratory system, Heart, Brain

4.1.4 Migration in Birds

4.1.5 Flight adaptation in birds

## **Unit - V**

### **5.1 Mammalia**

5.1.1 General characters of Mammalia

5.1.2 Classification of Mammalia upto sub - classes with examples

### **5.2 Comparision of Prototherians, Metatherians and Eutherians**

### **5.3 Dentition in mammals**



## PAPER – II : PRACTICAL

### ANIMAL DIVERSITY - CHORDATES

Periods: 24

Max. Marks: 50

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#### Observation of the following slides / spotters / models

- Protochordata** : *Herdmania, Amphioxus, Amphioxus* T.S. through pharynx
- Cyclostomata** : *Petromyzon, Myxine*
- Pisces** : *Pristis, Torpedo, Channapleuronectes, Hippocampus, Exocoetus, Ehenis, Labeo, Catla, Clarius, Auguilla, Protopterus*  
Placoid scale, Cycloid scale, Ctenoid scale
- Amphibia** : *Ichthyophis, Amblystoma, Siren, Hyla, Rachophous*  
Axolotl larva
- Reptilia** : *Draco, Chamaeleon, Uromastix, Vipera russeli, Naja, Bungarus, Enhydrina, Testudo, Trionyx, Crocodilus*
- Aves** : *Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo*, Study of different types of feathers: Quill, Contour, Filoplume down
- Mammalia** : *Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris*, Hedgehog
- Osteology** : Appendicular skeletons of Varanus, Pigeon  
Rabbit - Skull, fore limbs, hind limbs and girdles

#### Demonstration of dissection / dissected / virtual dissection:

1. V, VII, IX, X cranial nerves of shark / locally available fishes
2. Arterial system, venous system of Shark / Calotes / Fowl / Rat
3. Digestive system of fish

**b Laboratory record work shall be submitted at the time of practical examination**

**b Compulsory one species to be adopted for demonstration only be the faculty**



# ADIKAVI NANNAYA UNIVERSITY

## RAJAMAHENDRAVARAM

### CBCS / Semester System

(W.e.f. 2015-16 Admitted Batch)

#### III Semester Syllabus

#### ZOOLOGY

#### CYTOLOGY, GENETICS AND EVOLUTION

**Periods:60**

**Max. Marks:100**

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#### Unit - I

##### 1. Cytology - I

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
- 1.2 Electron microscopic structure of eukaryotic cell.
- 1.3 Plasma membrane –Different models of plasma membrane.

#### Unit – II

##### 2. Cell organelles

- 2.1 Structure and functions of Endoplasmic Reticulum
- 2.2 Structure and functions of Golgi apparatus
- 2.3 Structure and functions of Lysosomes
- 2.4 Structure and functions of Ribosomes
- 2.5 Structure and functions of Mitochondria
- 2.6 Nucleus
- 2.7. Chromatin - Structure and significance, Chromosomes - Structure, types, functions

#### Unit - III

##### 3.1 Genetics - I

- 3.1.1 Mendel's work on transmission on traits
- 3.1.2 Principles of inheritance
- 3.1.3 Incomplete dominance and codominance
- 3.1.4 Lethal alleles, Epistasis, Pleiotropy

#### Unit - IV

##### 4.1 Genetics - II

- 4.1.1 Sex determination
- 4.1.2 Sex linked inheritance
- 4.1.3 Linkage and crossing over
- 4.1.4 Extra chromosomal inheritance
- 4.1.5 Human karyotyping

## **Unit - V**

### **5.1 Evolution**

5.1.1 Origin of life

5.1.2 Lamarckism, Darwinism, Neo – Darwinism, Hardy-Weinberg Equilibrium.

5.1.3 Variations, isolating mechanisms, natural selection

5.1.4 Types of natural selection (directional, stabilizing, disruptive)

5.1.5 Artificial selection and forces of evolution

5.1.6 Speciation (Allopatric and Sympatric)

5.1.7 Macro evolutionary principles (Example: Darwin's finches)



# ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER

## ZOOLOGY - PAPER - III

### CYTOLOGY, GENETICS AND EVOLUTION

Periods: 24

Max. Marks: 50

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#### **I. Cytology**

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of *Chironomus*

#### **II. Genetics**

1. Study of Mendelian inheritance using suitable examples
2. Study of linkage recombination, gene mapping using the data
3. Study of human karyotypes

#### **III. Evolution**

1. Study of fossil evidences
2. Study of homology and analogy from suitable specimens and pictures
3. Phylogeny of horse with pictures
4. Darwin's finches (pictures)
5. Visit to natural history museum and submission of report



ADIKAVI NANNAYA UNIVERSITY  
CBCS/SEMESTER SYSTEM  
IV SEMESTER : B.SC ZOOLOGY  
W.E.F. 2015-16 ADMITTED BATCH

**ZOOLOGY - PAPER - IV**

**EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY**

**Periods:60**

**Max. Marks: 100**

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**Unit - I**

- 1.1 Developmental Biology and Embryology**
- 1.1.1 Gametogenesis
  - 1.1.2 Fertilization
  - 1.1.3 Types of eggs
  - 1.1.4 Types of cleavages
- 1.2 Development of Frog upto formation of primary germ layers
- 1.3 Formation and functions of Foetal membrane in chick embryo
- 1.4 Development, types and functions of Placenta in mammals

**Unit - II**

- 2.1 Physiology - I**
- 2.1.1 Elementary study of process of digestion
  - 2.1.2 Absorption of digested food
  - 2.1.3 Respiration - Pulmonary ventilation, transport of oxygen and carbondioxide
  - 2.1.4 Circulation - Structure and functioning of heart, Cardiac cycle
  - 2.1.5 Excretion - Structure of nephron, urine formation, counter current mechanism

**Unit - III**

- 3.1 Physiology - II**
- 3.1.1 Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers
  - 3.1.2 Muscle contraction - Ultra structure of muscle fibre, molecular and chemical basis of muscle contraction
  - 3.1.3 Endocrine glands - Structure, secretions and the functions (of hormones) of pituitary, thyroid, parathyroid, adrenal glands and pancreas
  - 3.1.4 Hormonal control of reproduction in a mammal

## **Unit - IV**

### **4.1 Ecology - I**

4.1.1 Meaning and scope of Ecology

4.1.2 Important abiotic factors of Ecosystem - Temperature, light, water, oxygen and CO<sub>2</sub>

4.1.3 Nutrient cycles - Nitrogen, carbon and phosphorus

4.1.4 Components of Ecosystem (Example:lake), food chains and food web, energy flow in ecosystem

## **Unit - V**

### **5.1 Ecology - II**

5.1.1 Habitat and ecological niche

5.1.2 Community interactions - Mutualism, commensalism, parasitism, competition, predation

5.1.3 Ecological succession

5.1.4 Population studies

### **5.2 Zoogeography**

5.2.1 Zoogeographical regions

5.2.2 Study of physical and faunal peculiarities of Oriental, Australian and Ethiopian regions



# **ZOOLOGY PRACTICAL SYLLABUS FOR IV SEMESTER**

## **ZOOLOGY - PAPER - IV**

### **EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY**

**Periods: 24**

**Max. Marks: 50**

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#### **I. Embryology**

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Study of chick embryos of 18 hours, 24 hours, 33 hours and 48 hours of incubation

#### **II. Physiology**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Qualitative tests for identification of ammonia, urea and uric acid
3. Study of activity of salivary amylase under optimum conditions
4. Study of prepared slides of T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage

#### **III. Ecology**

1. Determination of pH of given sample
2. Estimation of dissolved oxygen of given sample
3. Estimation of total alkalinity of given sample
4. Estimation of salinity of given sample



**ZOOLOGY MODEL PAPER FOR IV SEMESTER**

**ZOOLOGY - PAPER - IV**

**EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY**

**Time: 3 hrs**

**Max. Marks: 75**

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**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
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- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

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13.

OR



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**ZOOLOGY SYLLABUS FOR V SEMESTER**

**ZOOLOGY - PAPER - V**  
**ANIMAL BIOTECHNOLOGY**

**Periods:60**

**Max. Marks:100**

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**Unit 1: Tools of Recombinant DNA technology - Enzymes and Vectors**

**Restriction modification systems:** Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering

**DNA modifying enzymes and their applications:** DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases

**Cloning Vectors:** Plasmid vectors:pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs,

**Unit 2 Techniques of Recombinant DNA technology**

**Cloning:** Use of linkers and adaptors

**Gene delivery:** Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated delivery

**PCR:** Basics of PCR.

**DNA Sequencing:** Sanger's method of DNA sequencing- traditional and automated sequencing

**Hybridization techniques:** Southern, Northern and Western blotting,

**Genomic and cDNA libraries:** Preparation and uses

**UNIT 3 Animal Cell Technology**

**Cell culture media:** Natural and Synthetic

**Cell cultures:** primary culture, secondary culture, continuous cell lines; Protocols for Primary Cell Culture; Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures.

**Hybridoma Technology:** Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb

**Stem cells:** Types of stem cells, applications

**Unit 4 Reproductive Technologies & Transgenic Animals**

**Manipulation of reproduction in animals:** Artificial Insemination, *In vitro* fertilization , super ovulation, Embryo transfer, Embryo cloning

**Transgenic Animals:** Strategies of Gene transfer; Transgenic - sheep, - fish; applications

**Unit 5 Applied Biotechnology**

**Industry:** Fermentation: Different types of Fermentation: Short notes on - Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized; Downstream processing - Filtration, centrifugation, extraction, chromatography, spray drying and lyophilization

**Agriculture:** fisheries – monoculture in fishes, polyploidy in fishes; DNA fingerprinting



**ZOOLOGY MODEL PAPER FOR V SEMESTER**

**ZOOLOGY - PAPER - V**

**ANIMAL BIOTECHNOLOGY**

**Time: 3 hrs**

**Max. Marks: 75**

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**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

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**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

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**ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER**  
**ZOOLOGY - PAPER - V**  
**ANIMAL BIOTECHNOLOGY**

**Periods: 24**

**Max. Marks: 50**

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Any SIX of the following:

1. Maintenance and storage of *E. coli* DH5 alpha cells.
2. Isolation of Plasmid DNA from *E. coli*
3. Preparation of genomic DNA from *E. coli*/animals/ human.
4. DNA quantification using agarose gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda ( $\lambda$ ) DNA using EcoR1 and Hind III.
6. Preparation for insertion and vector for ligation.
7. Performance of ligation reaction using T4 DNA ligase.
8. Preparation of competent cells
9. Transformation of *E. coli* with plasmid DNA using CaCl<sub>2</sub>,
10. Selection of transformants on X-gal and IPTG
11. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
12. Interpretation of sequencing gel electropherograms
13. Amplification of DNA by PCR
14. Packing and sterilization of glass and plastic wares for cell culture.
15. Preparation of culture media.

**SUGGESTED READING**

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
5. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
6. Brown TA. (2007). Genomes-3. Garland Science Publishers
7. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
8. Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994. BIOS Scientific Publishers Limited.
9. Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
10. P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
11. B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001)





# ZOOLOGY SYLLABUS FOR V SEMESTER

## ZOOLOGY - PAPER - VI

### ANIMAL HUSBANDRY

**Periods:60**

**Max. Marks: 100**

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**UNIT – I**

:

**10 Hours**

General introduction to poultry farming. Principles of poultry housing. Poultry houses. Systems of poultry farming. Management of chicks, growers and layers. Management of Broilers.

**UNIT – II:**

**10 Hours**

Poultry feed management – Principles of feeding. Nutrient requirements for different stages of layers and broilers. Methods of feeding. Poultry diseases – viral, bacterial, fungal and parasitic (two each); symptoms, control and management.

**UNIT – III:**

**10 Hours**

Selection, care and handling of hatching eggs. Egg testing. Methods of hatching. Brooding and rearing. Sexing of chicks.

**UNIT- IV:**

**20 Hours**

Breeds of Dairy Cattle and Buffaloes – Definition of breed; Classification of Indian Cattle breeds, exotic breeds and Indian buffalo breeds. Systems of inbreeding and crossbreeding. Housing of dairy animals – Selection of site for dairy farm; systems of housing – loose, housing system. Conventional dairy barn. Cleaning and sanitation of dairy farm. Weaning of calf. Castration and dehorning. Deworming and Vaccination programme. Records to be maintained in a dairy farm.

**UNIT - V:**

**10 Hours**

Care and management of dairy animals - Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and bullocks.

**ZOOLOGY MODEL PAPER FOR V SEMESTER**

**ZOOLOGY - PAPER - VI**

**ANIMAL HUSBANDRY**

**Time: 3 hrs**

**Max. Marks: 75**

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**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
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- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

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**ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER**  
**ZOOLOGY –PRACTICAL - VI**

**ANIMAL HUSBANDRY**

**Periods:24**

**Max. Marks: 50**

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1. Study of various breeds of layers and broilers (photographs)
2. Identification of disease causing organisms in poultry birds (as per theory)
3. Study of the anatomy of a poultry bird by way of dissecting a bird. (Demonstration)
4. Study of various activities in a poultry farm (layers and broilers) and submission of a report.
5. Study of various breeds of cattle (photographs/microfilms)
6. Study of various activities carried out in a dairy farm and submission of a report.

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**ZOOLOGY SYLLABUS FOR VI SEMESTER**

**ZOOLOGY - ELECTIVE PAPER: VII-(B)**

**CELLULAR METABOLISM AND MOLECULAR BIOLOGY**

**Periods: 60**

**Max. Marks:100**

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**Unit I: Biomolecules**

- 1.1 Carbohydrates - Classification of carbohydrates. Structure of glucose
- 1.2 Proteins - Classification of proteins. General properties of amino acids
- 1.3 Lipids - Classification of lipids
- 1.4 Nucleic acids - DNA – Structure and function; RNA - Structure, types and functions

**Unit II: Enzymes and Cellular Metabolism**

- 2.1. Introduction to biocatalysis, Enzymes and their classification, Enzymekinetcs. Mechanism of action. Inhibition and Regulation
- 2.2 Carbohydrate Metabolism - Glycolysis, Krebs Cycle, Gluconeogenesis,
- 2.3 Glycogen metabolism, Review of electron transport chain

**Unit - III : Cellular Metabolism and Cell Physiology**

- 3.1 Lipid Metabolism - Biosynthesis and  $\beta$  oxidation of palmitic acid
- 3.2 Protein metabolism - Transamination, Deamination and Urea Cycle
- 3.3 Transport functions of plasma membrane – Active, passive and facilitated transport
- 3.4 Cell junctions – Tight junctions, desmosomes, gap junctions

**Unit - V: Gene Expression**

- 3.1 Gene Expression in prokaryotes (Lac Operon)
- 3.2 Gene Expression in eukaryotes.
- 3.3 Transcription and Translation.

**ZOOLOGY PRACTICAL SYLLABUS FOR VI SEMESTER**

**ZOOLOGY - ELECTIVE PAPER: VII-(B)**

**CELLULAR METABOLISM AND MOLECULAR BIOLOGY**

**Periods: 24**

**Max. Marks: 50**

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1. Qualitative tests to identify functional groups of carbohydrates in given Solutions (Glucose, Fructose, Sucrose, Lactose)
2. Estimation of total protein in given solutions by Lowry's method.
3. Study of activity of salivary amylase under optimum conditions
4. Preparation of permanent slide to show the presence of Barr body in Human female blood cells or cheek cells
5. Mounting of salivary gland chromosomes of *Chironomous*

**SUGGESTED READINGS**

J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition .W.H. Freeman and Co.

Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IVEdition. W.H. Freeman and Co.

Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Karp, G. (2010), Cell and molecular biology : Concepts and experiments. VI edition. John Wiley and sons. Inc.

De Robertis, EDP and De Robertis EMF (2006). Cell and molecular biology. VIII edition. Lippincott Williams and Wilkins, Philadelphia Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

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ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE –VIII-B:  
VI SEMESTER

AQUACULTURE

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Cluster Elective Paper: VIII-B-1

PRINCIPLES OF AQUACULTURE

Periods:60

Max.Marks:100

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**Unit – I**

**1.1 Introduction / Basics of Aquaculture**

- 1.1.1 Definition, Significance and History of Aquaculture
- 1.1.2 Present status of Aquaculture – Global and National scenario
- 1.1.3 Major cultivable species for aquaculture: freshwater, brackish water and marine.
- 1.1.4 Criteria for the selection of species for culture

**Unit – II**

**2.1 Types of Aquaculture**

- 2.1.1 Freshwater, Brackishwater and Marine
- 2.1.2 Concept of Monoculture, Polyculture, Composite culture, Monosex culture and

Integrated fish farming

**2.2 Culture systems**

- 2.2.1 Ponds, Raceways, Cages, Pens, Rafts and water recirculating systems

**2.3 Culture practices**

2.3.1 Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish and shrimp.

**Unit – III**

**3.1 Design and construction of aquafarms**

- 3.1.1 Criteria for the selection of site for freshwater and brackish water pond farms
- 3.1.2 Design and construction of fish and shrimp farms

**3.2 Seed resources**

- 3.2.1 Natural seed resources and Procurement of seed for stocking: Carp and shrimp

**3.3 Nutrition and feeds**

- 3.3.1 Nutritional requirements of a cultivable fish and shellfish
- 3.3.2 Natural food and Artificial feeds and their importance in fish and shrimp culture

**Unit – IV**

**4.1 Management of carp culture ponds**

- 4.1.1 Culture of Indian major carps: Pre-stocking management – Dewatering, drying, ploughing/desilting; Predators, weeds and algal blooms and their control, Liming and fertilization; Stocking management – Stocking density and stocking; Post-stocking management – Feeding, water quality, growth and health care; and Harvesting of ponds

**4.2 Culture of giant freshwater prawn, *Macrobrachium rosenbergii***

## Unit – V

**5.1 Culture of shrimp** (*Penaeus monodon* or *Litopenaeus vannamei*)

**5.2 Culture of pearl oysters**

**5.3 Culture of seaweeds**-species cultured, culture techniques, important by-products, prospects

**5.4 Culture of ornamental fishes** – Setting up and maintenance of aquarium; and breeding.

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**Cluster Elective Paper: VIII-B-2**

**AQUACULTURE MANAGEMENT**

**Periods : 60**

**Max.Marks : 100**

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**Unit – I**

**1.1 Breeding and Hatchery Management**

1.1.1 Bundh Breeding and Induced breeding of carp by Hypophysation; and use of synthetic hormones

1.1.2 Types of fish hatcheries; Hatchery management of Indian major carps

1.1.3 Breeding and Hatchery management of *Penaeus monodon*/ *Litopenaeus vannamei*

1.1.4 Breeding and Hatchery management of giant freshwater prawn.

**Unit – II**

**2.1 Water quality Management**

2.1.1 Water quality and soil characteristics suitable for fish and shrimp culture

2.1.2 Identification of oxygen depletion problems and control mechanisms in culture ponds

2.1.3 Aeration: Principles of aeration and Emergency aeration

2.1.4 Liming materials, Organic manures and Inorganic fertilizers commonly used and their implications in fish ponds

**Unit – III**

**3.1 Feed Management**

3.1.1 Live Foods and their role in shrimp larval nutrition.

3.1.2 Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed additives and Preservatives; role of probiotics.

3.1.3 Feed formulation and manufacturing; Feed storage

3.1.4 Feeding strategies: Feeding devices, feeding schedules and ration size; Feed evaluation- feed conversion efficiencies and ratios

**Unit – IV**

**4.1 Disease Management**

4.1.1 Principles of disease diagnosis and health management;

4.1.2 Prophylaxis, Hygiene and Therapy of fish diseases

4.1.3 Specific and non-specific defense systems in fish; Fish immunization and vaccination

4.1.4 Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish ponds

4.1.5 Etiology, Symptoms, prophylaxis and therapy of common shrimp diseases in shrimp ponds



## Unit – V

### 5.1 Economics and Marketing

5.1.1 Principles of aquaculture economics – Capital costs, variable costs, cost-benefit analysis

5.1.2 Fish marketing methods in India; Basic concepts in demand and price analysis

### 5.2 Fisheries Extension

5.1.3 Fisheries Training and Education in India; Role of extension in community development.

### 5.3 Fish Genetics

5.1.4 Genetic improvement of fish stocks – Hybridization of fish.

5.1.5 Gynogenesis, Androgenesis, Polyploidy, Transgenic fish, Cryopreservation of gametes, Production of monosex and sterile fishes and their significance in aquaculture.

### REFERENCE BOOKS

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3. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*. Daya Publ. House
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## **Unit – I**

### **1.1 Handling and Principles of fish Preservation**

1.1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.

1.1.2 Principles of preservation– cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

## **Unit – II**

### **2.1 Methods of fish Preservation**

2.1.1 Traditional methods - sun drying, salt curing, pickling and smoking.

2.1.2 Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, Irradiation and Accelerated Freeze drying (AFD).

## **Unit – III**

### **3.1 Processing and preservation of fish and fish by-products**

3.1.1 Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.

3.1.2 Fish by-products – fish glue, ising glass, chitosan, pearl essence, shark fins, fish leather and fish maws.

### **3.2 Seaweed Products**

3.2.1 Preparation of agar, algin and carrageen. Use of seaweeds as food for human consumption, in disease treatment and preparation of therapeutic drugs.

## **Unit – IV**

### **4.1 Sanitation and Quality control**

4.2.1 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.

4.2.2 Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.

### **4.2 Regulatory affairs in industries**

## **Unit – V**

### **5.1 Quality Assurance, Management and Certification**

5.1.1 Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.

5.1.2 National and International standards – ISO 9000: 2000 Series of Quality Assurance System, *Codex Alimentarius*.

## **REFERENCE BOOKS**

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**VI SEMESTER**  
**AQUACULTURE**

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**PRACTICAL: I**

**Periods : 24**

**Max.Marks : 50**

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**Cultivable fishes**

1. Identification and study of important cultivable and edible fishes - Any ten
2. Identification and study of important cultivable and edible crustaceans - Any five
3. Identification and study of common aquarium fishes – Any five
4. General description and recording biometric data of a given fish.

**Diseases**

1. Identification and study of fish and shrimp diseases - Using specimens / pictures
2. External examination of the diseased fish – diagnostic features and procedure.
3. Autopsy of fish – Examination of the internal organs.
4. Determination of dosages of chemicals and drugs for treating common diseases.

**Pond Management**

1. Water Quality -Determination of temperature, pH, salinity in the pond water sample; Estimation of dissolved oxygen, free carbondioxide, total alkalinity, total hardness, phosphates and nitrites.
2. Soil analysis – Determination of soil texture, pH, conductivity, available nitrogen, available phosphorus and organic carbon.
3. Identification and study of common zooplankton, aquatic insects and aquatic weeds – Each 5

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**PRACTICAL - II**

**Periods :24**

**Max.Marks : 50**

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**Nutrition**

1. Identification and study of Live food organisms – Any five
2. Formulation and preparation of a balanced fish feed
3. Estimation of Proximate composition of aquaculture feeds – Proteins, carbohydrates, lipids, moisture, ash content.
4. Gut content analysis to study artificial and natural food intake.

**Post harvest Technology**

1. Evaluation of fish/ fishery products for organoleptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish products, examination of salt, protein, moisture in dried / cured products, examination of spoilage of dried / cured fish products, marinades, pickles, sauce.
3. Preparation of isinglass, collagen and chitosan from shrimp and crab shell. ?
4. Developing flow charts and exercises in identification of hazards – preparation of hazard analysis worksheet, plan form and corrective action procedures in processing of fish.

**PRACTICAL - III**

**Project Work**

Visit to a fish breeding centre / fish farms and submit a project report  
or  
Visit to a feed manufacturing unit and submit a project report

or

Visit to a shrimp hatchery / shrimp farms and submit a project report

or

Visit to a shrimp processing unit and submit a project report