

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE  
(AUTONOMOUS)  
KAKINADA**



**BOARD OF STUDIES  
DEPARTMENT OF ZOOLOGY  
2021-22  
(CHOICE BASED CREDIT SYSTEM)**

**P.R.GOV.T. COLLEGE (AUTONOMOUS) KAKINADA.**  
**2020 -21, BOARD OF STUDIES MEETING. Dt.02.12.2021**  
**DEPARTMENT OF ZOOLOGY**

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The members present have discussed the syllabi and model question papers (Theory and Practical) related to I to VI semesters in ZOOLOGY

**Resolution I:** Resolved to Continue CBCS System

**Resolution II:** Resolved to implement 50 % external and 50% internal marks for theory from the academic year 2021-22 admitted batch, and 60% - 40 % for existing batches

**Resolution III:** Resolved to split 50 marks of theory internal as 25 marks for mid exams and 10 marks for co-curricular activities (assignment/quiz/group discussion) 10 Marks for Mini project and 5 Marks for (seminar) presentation .

**Resolution VI:** Resolved to introduce SDC as prescribed by the APSCHE. Department of Zoology anchoring the Dairy Technology for the II semester, Environmental Science, Health and Hygiene in the III semester

**Resolution VIII:** Resolve to continue Internship for the VI semester students with the help of APSSDC located in the college campus

**Resolution IX:** Resolve to include question bank for all the six semesters.

**Resolution X:** Resolved to continue the same paper setters and examiners for all the semesters.

**Resolution XI:** Resolved to include Blue Prints for model question papers for all semesters.

**Chairperson**  
**Board of Studies**  
**Dept. of Zoology**

**P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**DEPARTMENT OF ZOOLOGY**

BOARD OF STUDIES MEETING 2021-22

CHOICE BASED CREDIT SYSTEM

2020-21 admitted batch onwards

| YEAR | SEM | PAPER | TITLE                                                       | MARKS (100) |     | CREDITS |
|------|-----|-------|-------------------------------------------------------------|-------------|-----|---------|
|      |     |       |                                                             | MID         | END |         |
| I    | I   | I     | Animal Diversity – I                                        | 50          | 50  | 04      |
|      |     |       | Biology of Non-<br>Practical - I                            |             | 50  | 01      |
|      | II  | II    | Animal Diversity – II<br>Biology of Chordates               | 50          | 50  | 04      |
|      |     |       | Practical - II                                              |             | 50  | 01      |
| II   | III | III   | Cell biology, Genetics,<br>Molecular Biology &<br>Evolution | 60          | 40  | 04      |
|      |     |       | Practical - III                                             |             | 50  | 01      |
|      | IV  | IV    | Physiology, Cellular<br>Metabolism &<br>Embryology          | 60          | 40  | 04      |
|      |     |       | Practical - IV                                              |             | 50  | 01      |
|      |     | V     | Immunology & Animal<br>Biotechnology                        | 60          | 40  | 04      |
|      |     |       | Practical - V                                               |             | 50  | 01      |

For previous year admitted batches

| S. No. | Semester No. | Domain Specific course/Clusters | Title                              | Marks | Credits |
|--------|--------------|---------------------------------|------------------------------------|-------|---------|
| 1      | I            | General Core                    | Animal diversity I                 | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
| 2      | II           | General Core                    | Animal diversity II                | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
| 3      | III          | General Core                    | Cytology ,genetics and evolution   | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
| 4      | IV           | General Core                    | Embryology, Physiology and Ecology | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
| 5      | V            | General core                    | Animal Biotechnology               | 100   | 03      |
| Lab    |              |                                 | 50                                 | 02    |         |
| 6      |              | General Core                    | Animal Husbandry                   | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
| 7      | VI           | Elective II                     | Immunology                         | 100   | 03      |
| Lab    |              |                                 | 50                                 | 02    |         |
| 8      |              | Cluster Elective A1             | Principles of Aquaculture          | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
|        |              | Cluster Elective A2             | Aquaculture Management             | 100   | 03      |
|        |              |                                 | Lab                                | 50    | 02      |
|        |              | Cluster Elective A3             | Post-Harvest Technology            | 100   | 03      |
|        |              |                                 | Project work                       | 50    | 02      |

**P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**DEPARTMENT OF ZOOLOGY**

BOARD OF STUDIES MEETING 2021- 22  
CHOICE BASED CREDIT SYSTEM

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The BOARD OF STUDIES Meeting of the Department of Zoology took place 02:00 PM on 02.12.2021 in the ONLINE BOS The following members attended.

| Sl No | Name and affiliation                                                                                            | Designation                     | Signature |
|-------|-----------------------------------------------------------------------------------------------------------------|---------------------------------|-----------|
| 01    | Sri. B. Chakravarthi<br>Lecturer in-charge<br>Dept of Zoology<br>P R College (Autonomous)<br>KAKINADA.          | Chairperson                     |           |
| 02    | Dr.K, Ramaneswari<br>Prof. in Zoology<br>Dept. of Zoology<br>Adikavi Nannaya<br>University<br>RAJAHMAHENDRAVARM | Subject<br>Expert               |           |
| 03    | Dr.D. Padmavathi<br>Rtd. Senior Lecturer in<br>Zoology<br>M.S.N. Degree College<br>KAKINADA                     | Subject<br>Expert               |           |
| 04    | Dr.M. Tejo Murthy<br>Lecturer in Zoology<br>PV KN GOVT<br>COLLEGE(A), Chittor                                   | Vice-<br>chancellors<br>Nominee |           |
| 05    | Dr.P. Rama Mohan Rao<br>Aquaculture Consultant                                                                  | Aqua<br>Industry<br>Consultant  |           |

**DEPARTMENTAL STAFF**

1. B. Ahmed Ali Baba  
Lecturer in Zoology  
P.R.Govt College (A)  
Kakinada.

Member

|                                                                                           |        |
|-------------------------------------------------------------------------------------------|--------|
| 2. Dr.N.Sreenivas<br>Lecturer in Zoology<br>P.R.Govt College (A)<br>Kakinada.             | Member |
| 3. Dr. P. Kiran Kumar<br>Lecturer in Zoology<br>P.R.Govt College (A)<br>Kakinada.         | Member |
| 4. Dr. B. Elia<br>Lecturer in Zoology<br>P.R.Govt College (A)<br>Kakinada.                | Member |
| 5. Sk. Madina Saheb<br>Lecturer in Zoology (Contract)<br>P.R.Govt College (A)<br>Kakinada | Member |
| 6. P.Vijaya Chandrika<br>Lecturer in Zoology (Guest)<br>P.R.Govt College (A)<br>Kakinada  | Member |
| 7. Y. Gowthami<br>Lecturer in Zoology (Guest)<br>P.R.Govt College (A)<br>Kakinada         | Member |
| 8. I. Shanthi Grace<br>Lecturer in Zoology (Guest)<br>P.R.Govt College (A)<br>Kakinada    | Member |
| 9. G. Bhuvan Teja<br>Lecturer in Zoology (Guest)<br>P.R.Govt College (A)<br>Kakinada      | Member |
| 10. K. Anusha<br>Lecturer in Zoology (Guest)<br>P.R.Govt College (A)<br>Kakinada          | Member |
| 11. B. Devi<br>Lecturer in Zoology (Guest)<br>P.R.Govt College (A)<br>Kakinada            | Member |

## LIST OF EXAMINERS

### DEPARTMENT OF ZOOLOGY

| S.No | Name of the Examiners | Subject | Name of the College                    |
|------|-----------------------|---------|----------------------------------------|
| 1    | P JOHN KIRAN          | ZOOLOGY | GDC PERUMALLAPURAM                     |
| 02   | M. VIJAYASANTHI       | ZOOLOGY | ASD COLLEGE ,KAKINADA                  |
| 03   | M.VIJAYA KUMAR        | ZOOLOGY | SRR GDC VIJAYAWADA                     |
| 04   | P.JAYA                | ZOOLOGY | VSK COLLEGE, VIZAG                     |
| 05   | K. USHA RANI          | ZOOLOGY | ARTS COLLGE<br>RAJAHMUNDRY             |
| 06   | N. SUNEETHA           | ZOOLOGY | SRR GDC , VIJAYAWADA                   |
| 07   | R.INDIRA              | ZOOLOGY | ST.THERESSA COLLEGE,<br>ELURU          |
| 08   | V. SANDHYA            | ZOOLOGY | GDC, KAIKALURU                         |
| 09   | V.V.PADMAVATHI        | ZOOLOGY | ST.THERESSA COLLEGE,<br>ELURU          |
| 10   | K BABU                | ZOOLOGY | GOVERNEMTN ARTS<br>COLLEGE RAJAHMUNDRY |
| 11   | DR R P DATTU          | ZOOLOGY | GDC TIRUVURU                           |
| 12   | DR IS CHAKRAPANI      | ZOOLOGY | GDC VIDAVALURU                         |
| 13   | DR. G SRINIVAS        | ZOOLOGY | GDC KARNOOL                            |
| 14   | MADHAVI RANI          | ZOOLOGY | ST.THERESSA COLLEGE,<br>ELURU          |
| 15   | M VASANTHA LAKSHMI    | ZOOLOGY | ASD COLLEGE KAKINADA                   |
| 16   | K RAMA RAO            | ZOOLOGY | VSK COLLEGE,<br>VISHAKAPATNAM          |
| 17   | T SAMUEL DAVID RAJ    | ZOOLOGY | VSK COLLEGE,<br>VISHAKAPATNAM          |
| 18   | P R VANI              | ZOOLOGY | VSK COLLEGE,<br>VISHAKAPATNAM          |
| 19   | K SAMBASIVA RAO       | ZOOLOGY | GDC MYLAVARM                           |
| 20   | G VANI                | ZOOLOGY | GDC TADEPALLIGUDEM                     |

**Lecturer in charge- Dept of Zoology**

***LIST OF QUESTION PAPER SETTERS***

| <b>S.No</b> | <b>Name of the Examiners</b> | <b>Subject</b> | <b>Name of the College</b>            |
|-------------|------------------------------|----------------|---------------------------------------|
| 1           | P JOHN KIRAN                 | ZOOLOGY        | GDC PERUMALLAPURAM                    |
| 02          | M. VIJAYASANTHI              | ZOOLOGY        | ASD COLLEGE ,KAKINADA                 |
| 03          | M.VIJAYA KUMAR               | ZOOLOGY        | SRR GDC VIJAYAWADA                    |
| 04          | P.JAYA                       | ZOOLOGY        | VSK COLLEGE, VIZAG                    |
| 05          | K. USHA RANI                 | ZOOLOGY        | ARTS COLLGE<br>RAJAHMUNDRY            |
| 06          | N. SUNEETHA                  | ZOOLOGY        | SRR GDC , VIJAYAWADA                  |
| 07          | R.INDIRA                     | ZOOLOGY        | ST.THERESSA COLLEGE,<br>ELURU         |
| 08          | V. SANDHYA                   | ZOOLOGY        | GDC, KAIKALURU                        |
| 09          | V.V.PADMAVATHI               | ZOOLOGY        | ST.THERESSA COLLEGE,<br>ELURU         |
| 10          | K BABU                       | ZOOLOGY        | GOVERNMTN ARTS<br>COLLEGE RAJAHMUNDRY |
| 11          | DR R P DATTU                 | ZOOLOGY        | GDC TIRUVURU                          |
| 12          | DR IS CHAKRAPANI             | ZOOLOGY        | GDC VIDAVALURU                        |
| 13          | DR. G SRINIVAS               | ZOOLOGY        | GDC KARNOOL                           |
| 14          | MADHAVI RANI                 | ZOOLOGY        | ST.THERESSA COLLEGE,<br>ELURU         |
| 15          | M VASANTHA LAKSHMI           | ZOOLOGY        | ASD COLLEGE KAKINADA                  |
| 16          | K RAMA RAO                   | ZOOLOGY        | VSK COLLEGE,<br>VISHAKAPATNAM         |
| 17          | T SAMUEL DAVID RAJ           | ZOOLOGY        | VSK COLLEGE,<br>VISHAKAPATNAM         |
| 18          | P R VANI                     | ZOOLOGY        | VSK COLLEGE,<br>VISHAKAPATNAM         |
| 19          | K SAMBASIVA RAO              | ZOOLOGY        | GDC MYLAVARM                          |
| 20          | G VANI                       | ZOOLOGY        | GDC TADEPALLIGUDEM                    |

**Lecturer in charge-Dept of Zoology**

**BOS-ZOOLOGY-2021-22**  
**P.R. GOVERNMENT COLLEGE (A), KAKINADA**  
**I B.Sc., (BZC), SEMESTER-I**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**  
**Course Code: ZO 1208**  
**Hrs: 4 Credits: 4**

| <b>COURSE OUT COMES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>LEARNING OUTCOMES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> Describe general taxonomic rules on animal classification<br><b>CO2</b> Classify Protozoa to Coelenterata with taxonomic keys<br><b>CO3</b> Classify Phylum Platyhelminthes to Annelida phylum using examples from parasitic adaptation and vermiculture<br><b>CO4</b> Describe Phylum Arthropoda to Mollusca using examples and importance of insects and Molluscs<br><b>CO5</b> Describe Echinodermata to Hemichordata with suitable examples and larval stages in relation to the phylogeny | 1. To understand the taxonomic position of phyla from Protozoa to Helminthes.<br>2. To understand the general characteristics of animals belonging to phyla from Protozoa to Hemichordata.<br>3. To understand the structural organization of animals from phylum Protozoa to Hemichordata.<br>4. To understand the origin and evolutionary relationship of different phyla from Protozoa to Hemichordata.<br>5. To understand the origin and evolutionary relationship of different phylum from Annelida to Hemichordates |

**MODULE-I (PROTOZOA & PORIFERA)**

**15 Hrs**

- 1.1. Principles of Taxonomy- Binomial Nomenclature- Whittaker's Five kingdom Concept
- 1.2 General Characters and classification of Protozoa upto classes.
- 1.3. Elphidium Type study- structure and Life history;
- 1.4 Protozoan Locomotion and Reproduction – Binary fission and Conjugation.
- 1.5 General Characters and classification of Porifera upto classes
- 1.6 Skeleton in sponges - Canal system in Sponges

**MODULE-II (CNIDARIA, PLATYHELMINTHES & NEMATODA)**

**15Hrs**

- 2.1. General Characters and classification of Coelenterata upto classes.
- 2.2. Obelia: Structure of Polyp and Medusa.
- 2.3. Polymorphism in Coelenterates; Corals and Coral reef formation.
- 2.4. General characters of Phylum Ctenophora
- 2.5. General Characters and classification of Platyhelminthes upto classes.

- 2.6. *Fasciola hepatica*: Life cycle of *Fasciola hepatica*  
 2.7 General Characters and classification of Nematoda upto classes.  
 2.8. Life Cycle and pathogenicity of *Ascaris lumbricoides*

### **MODULE-III (ANNELIDA, ARTHROPODA & ONYCHOPHORA)**

**15Hrs**

- 3.1. *General Characters and classification of Annelida upto classes*  
 3.2. Evolution of Coelom and Coelomoducts,  
 3.3. Vermiculture-scope, significance and economic importance of Vermicompost  
 3.4. *General Characters and classification of Arthropoda upto classes*  
 3.5. Vision and Respiration in arthropoda, Metamorphosis in Insects  
 3.6. *Peripatus*- Affinities and Significance

### **MODULE-IV (MOLLUSCA, ECHINODERMATA AND HEMICHORDATA) 15 Hrs**

- 4.1. *General Characters and classification of Mollusca upto classes*  
 4.2. Pearl formation in Pelecypoda, Sense organs in Mollusca  
 . *General Characters and classification of Echinodermata upto classes*  
 4.3. Water vascular system in Star Fish  
 4.4. General characters and classification of Hemichordata up to classes with suitable examples  
 4.5. Balanoglossus: Structure and affinities.  
 4.6. Non Chordate Larval Forms Trochophore, Nauplius, Bipinnaria, Tornaria.

### **Co-curricular activities (suggested)**

- Preparation of chart/model of phylogenic tree of life, 5-kingdom classification, Elphidium life cycle etc.
- Visit to Zoology museum or Coral island as part of Zoological tour
- Charts on life cycle of Obelia, polymorphism, sponge spicules
- Clay models of canal system in sponges
- Preparation of charts on life cycles of *Fasciola* and *Ascaris*
- Visit to adopted village and conducting awareness campaign on diseases, to people as part of Social Responsibility.
- Plaster-of-paris or Thermocol model of *Peripatus*
- Construction of a vermicompost in each college, manufacture of manure by students and donating to local farmers
- Models of compound eye, bee hive and termitarium (termitaria) by students
- Visit to apiculture centre and short-term training as part of apprenticeship programme of the govt. Of Andhra Pradesh
- Chart on pearl forming layers using clay or Thermocol
- Visit to a pearl culture rearing industry/institute
- Live model of water vascular system
- Phylogeny chart on echinoderm larvae and their evolutionary significance
- Preparation of charts depicting the feeding mechanism, 3 coeloms, tornaria larva etc., of *Balanoglossus*

## **REFERENCES**

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS.
- 6 P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**I B.Sc., (BZC), SEMESTER-I**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**  
**COURSE CODE: ZO 1208**  
**MODEL QUESTION PAPER**

**Time: 2 ½ hrs.**

**Max Marks: 50**

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**PART – 1**

**Note: Answer any THREE questions choosing at least one question from each section. Draw labelled diagrams whenever necessary 3X10=30M**

**SECTION-A (MODULE-I & II)**

1. Write an essay on Reproduction in *Elphidium*
2. Write an essay on Canal system in sponges
3. Write an account of life history of Liver Fluke

**SECTION-B (MODULE III & IV)**

4. Write an essay on the affinities of *Peripatus* and its significance
5. Describe the pearl formation in *Pelecypoda*.
6. Describe the water vascular system in *Starfish*

**Part – II**

**Answer any FOUR questions**

**4x5=20M**

1. Binomial Nomenclature
2. *Obelia* Polyp
3. *Miracidium*
4. *Coelomoducts*
5. Antennary glands
6. *Bipinnaria*
7. Affinities of *Balanoglossus*.

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**I B.Sc., (BZC), SEMESTER-I**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**  
**BLUE PRINT FOR QUESTION PAPER SETTER**  
**Max Marks: 50** **Time : 2 ½ hrs**

| <b>MODULE NO. &amp; NAME</b>                                     | <b>ESSAY<br/>QUESTIONS<br/>10 MARKS</b>                           | <b>SHORT<br/>ANSWER<br/>QUESTIONS<br/>5 MARKS</b>                 | <b>MARKS<br/>ALLOTTED TO<br/>THE UNIT</b>                                                                                      |
|------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>MODULE – I</b><br>(Protozoa & Porifera)                       | 01                                                                | 01                                                                | 15                                                                                                                             |
| <b>MODULE – II</b><br>(Cnidaria, Platyhelminthes<br>&Nematoda)   | 02                                                                | 02                                                                | 30                                                                                                                             |
| <b>MODULE – III</b><br>(Annelida,<br>Arthropoda&Onychophora)     | 01                                                                | 02                                                                | 20                                                                                                                             |
| <b>MODULE – IV</b> (Mollusca,<br>Echinodermata<br>&Hemichordata) | 02                                                                | 02                                                                | 30                                                                                                                             |
| <b>Total No.of Questions</b>                                     | <b>06</b><br><b>Of which 3 to</b><br><b>be</b><br><b>Answered</b> | <b>07</b><br><b>Of which 4 to</b><br><b>be</b><br><b>answered</b> | <b>95</b><br><b>Marks</b><br><b>including</b><br><b>choice.</b><br><b>Of which 50</b><br><b>Marks to be</b><br><b>answered</b> |

**NOTE:**The question paper setters are requested to kindly adhere to the format given in the above table.

**I B.Sc., (BZC), SEMESTER-I**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**  
**PRACTICAL SYLLABUS (with effective from 2021-22)**

**Learning Outcomes:**

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labeled record of identified museum specimens

**I. DISSECTIONS-Only Demonstration**

- a) Mounting of Cephalothoracic and abdominal appendages of Prawn
- b) Nervous system of Prawn
- c) Digestive system of Prawn
- d) Insect Mouth Parts
- e) An “**Animal album**” containing photographs, cut outs, with appropriate write up

about the above mentioned taxa. Different taxa/ topics may be given to different set of students for this purpose

- f) Computer - aided techniques should be adopted or show virtual dissections

**II. OBSERVATION OF THE FOLLOWING SLIDES / SPECIMENS / MODELS:**

1. Protozoa – Amoeba, Entamoeba, Plasmodium, Elphidium, Paramoecium – binary fission and Conjugation.
2. Porifera – Cydon, Spongilla, Euspongia.
3. Coelenterata - Physalia, Aurelia, Obelia colony, Medusa Corallium, Gorgonia,
4. Platyhelminthes and Nematelminthes – Ascaris - male & female, Larval stages of Fasciola, Miracidium, Redia, Cercaria, Ancylostoma duodenale, Taenia solium, Wuchereria.
5. Annelida - Nereis, Hirudinaria, Trochophore larva, Chaetopus
6. Arthropoda - Sacculina, Limulus, Julus, Scolopendra, Peripatus. Larvae: Nauplius, Mysis, Zoea, Mouthparts of Anopheles and Culex mosquitoes
7. Mollusca - Chiton, Unio, Sepia, Octopus, Nautilus, Glochidium larva.
8. Echinodermata – Asterias, Ophiothrix, Echinus, Cucumaria, Antedon, Bipinnaria larva.
9. Hemichordata – Balanoglossus, Tornaria larva.

**REFERENCE MANUALS:**

1. Practical Zoology- Invertebrates S.S. Lal
2. Practical Zoology - Invertebrates P.S. Verma
3. Practical Zoology - Invertebrates K.P. Kurl
4. Ruppert and Barnes (2006) Invertebrate Zoology, 8th Edition, Holt Saunders International Edition

**I B.Sc., (BZC), SEMESTER-I**  
**(WITH EFFECTIVE FROM 2021-2022)**  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**  
**PRACTICAL MODEL**  
**PAPER**  
**(AT THE END OF I-SEMESTER-EFFECTIVE FROM 2021-22)**

**Max marks: 50**

**Time : 2Hrs**

1. Dissect and display the nervous system of Palaemon. Draw a neat labelled diagram 10M

2. Identification of spotters 4X5=20M

A) .....

B) .....

C) .....

D) .....

E) .....

3. Record 05M

4. Continuous Internal Assessment 15M

Total **50M**

**QUESTION BANK**  
**B.Sc., I semester BZC Zoology**  
**Paper-I Animal diversity –Biology of Non-Chordates**

**Essay questions**

**MODULE-I**

1. Life Cycle of Elphidium.
2. Whittakers five kingdom classification
3. Locomotion in Protozoa
4. Canal system in sponges
5. Skeleton in sponges

**MODULE-II**

6. Polymorphism in Coelenterates.
8. Corals and Coral Reefs and their Formation.
9. Life Cycle of Fasciola hepatica
10. Life Cycle of Ascaris

**MODULE-III**

10. Vermiculture and making of Vermicompost
11. Respiration in Arthropoda
13. Metamorphosis in Insects
12. Affinities of Peripatus

**MODULE-IV**

14. Pearl formation in Pelecypoda
13. General characters of Echinodermata
15. Water vascular system in star fish.
16. Structure and affinities of Balanoglossus.

**SHORT ANSWERS**

**MODULE-I**

1. Binomial Nomenclature
2. Outline classification of protozoa.
3. Class Calcarea.
4. Class Hexactinellida
5. Class Demospongiae
7. Elphidium structure.
9. Monaxon spicules

**MODULE-II**

10. Characters of Cnidaria
11. Ctenophora
11. General characters of Platyhelminthes
12. General characters of Nematoda

- 13. Obelia Polyp
- 14. Obelia Medusa
- 16. Corals
- 17. Redia larva
- 18. Miracidium
- 20. Ascaris pathogenicity

### **MODULE-III**

- 21. Annelida General characters
- 23. Coelomoducts
- 24. Vermicompost
- 26. Respiration in Arthropoda
- 28. Vision in Arthropoda
- 29. Class Oligochaeta
- 30. Class Polychaeta
- 31. Class Hirudinea
- 32. Class Crustacea
- 33. Peripatus

### **MODULE-IV**

- 34. Mollusca characters
- 35. Echinodermata characters
- 36. Pearl formation
- 37. Sense organs in Mollusca
- 38. Water vascular system
- 39. Balanoglossus structure
- 40. Trochophore
- 41. Nauplius
- 42. Bipinnaria
- 43. Tornaria larva

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**I B.Sc., (BZC), SEMESTER-II**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**  
**Course Code: ZO 2208**

Hrs: 4

Credits: 4

| <b>COURSE OUT COMES</b>                                                                                                                                                                                                                                                                                                                                                                          | <b>LEARNING OUTCOMES</b>                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 Describe general taxonomic rules on animal classification of chordates<br>CO2 Classify Protochordata to Mammalia with taxonomic keys<br>CO3 Understand Mammals with specific structural adaptations<br>CO4 Understand the significance of dentition and evolutionary significance<br>CO5 Understand the origin and evolutionary relationship of different phyla from Prochordata to Mammalia | 1. To understand the animal kingdom .<br>2. To understand the taxonomic position of Protochordata to Mammalia.<br>3. To understand the general characteristics of animals belonging to Fishes to Reptilians.<br>4. To understand the body organization of Chordata.<br>5. To understand the taxonomic position of Protherian mammals |

**MODULE-I (PROTOCHORDATES)**

**18Hrs**

- 1.1.General Characters and Classification of Chordates upto classes.
- 1.2 Salient features of Urochordata and Cephalochordata  
Salient features of Cyclostomes
- 1.3 General Characters and Classification of Fishes upto sub class level,
- 1.4.Structure and life-history of *Herdmania*, Significance of retrogressive Metamorphosis.

**MODULE-II (FISHES & AMPHIBIA)**

**12Hrs**

- 2.1. *Scoliodon*: Morphology, structure of Heart, Brain and sense organs.
- 2.2. Migration in fishes and types of scales - Dipnoi fishes
- 2.3 *Characters and Classification of Amphibia upto orders*
- 2.4. *Rana* : Morphology, respiratory system, structure of heart, Brain and reproductive systems only.

**MODULE-III (REPTILIA)**

**12Hrs**

- 3.1. *Characters and Classification of Reptilia upto orders*
- 3.2. *Calotes*: Morphology, digestive system, urinogenital system and Brain
- 3.3. Identification of Poisonous snakes

**MODULE-IV (AVES & MAMMALS)**

**18Hrs**

- 4.1. General characters of Aves and Classification of Mammals- comparison of Prototheria, Metatheria and Eutheria
- 4.2. Pigeon (*Columbia livia*) : Exoskeleton, respiratory system, structure of heart,

- 4.3. Migration in birds and its significance, Flight adaptation in birds  
4.4. Dentition in Mammals,

### **Co-curricular activities (suggested)**

- Preparation of charts on Chordate classification (with representative animal photos) and retrogressive metamorphosis
- Thermocol or Clay models of Herdmania and Amphioxus
- Visit to local fish market and identification of local cartilaginous and bony fishes
- Maintaining of aquarium by students
- Thermocol model of fish heart and brain
- Preparation of slides of scales of fishes
- Visit to local/nearby river to identify migratory fishes and prepare study notes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrate heart/brain/lungs, identification of snakes etc.)
- Collecting and preparation of Museum specimens with dead frogs/snakes/lizards etc., and/or their skeletons
- Additional input on types of snake poisons and their antidotes (student activity).
- Collection of bird feathers and submission of report on Plumology
- Taxidermic preparation of dead birds for Zoology museum
- Chart preparation for dentition in mammals

### **REFERENCE BOOKS**

- J.Z. Young, 2006. The life of vertebrates. (The Oxford University Press, New Delhi). 646 pages. Reprinted
- Arumugam, N. Chordate Zoology, Vol. 2. SarasPublication. 278 pages. 200 figs.
- A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd.,UK). 852 pages. (Revised edition of Parker & Haswell, 1961).
- M. EkambaranathaAyyar, 1973. A manual of zoology. Part II. (S. Viswanathan Pvt. Ltd., Madras).
- P.S. Dhami & J.K. Dhami, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.
- Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books, Vols., 1573 pp., tables, figs.
- A.K. Sinha, S. Adhikari & B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages.
- R.L. Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut).

**I B.Sc., (BZC), SEMESTER-II**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**  
**Course Code: ZO 2208**  
**MODEL QUESTION PAPER**

**Time: 2 ½ hrs.**

**Max Marks: 50**

**PART – 1**

**Note :Answer any THREE questions choosing at least one question from each section. Draw the diagrams where ever necessary 3 X10 = 30**

**SECTION- A (MODULE-I & II)**

1. What is retrogressive metamorphosis? Discuss with special reference to the life history of an Ascidian and write its significance
2. Explain migration in fishes
3. Explain the structure of heart of frog

**SECTION-B (MODULE III & IV)**

4. Explain the urinogenital system of Calotes with a neat labelled diagram
5. Explain the various flight adaptations in birds
6. Write an essay on Dentition in mammals

**Part – II**

Answer any **FOUR** questions

**4x5=20**

1. Cephalochordata
2. Placoid scales
3. Buccopharyngeal respiration
4. Crocodilia
5. Brain in Calotes
6. Quill feather
7. Prototheria

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**I B.Sc., (BZC), SEMESTER-II**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**  
**BLUE PRINT FOR QUESTION PAPER SETTER**  
**Max Marks: 50**  
**Time : 2 ½ hrs**

| <b>MODULE NO. &amp; NAME</b>                | <b>ESSAY QUESTIONS<br/>10 MARKS</b>           | <b>SHORT ANSWER QUESTIONS<br/>5 MARKS</b>     | <b>MARKS ALLOTTED TO THE UNIT</b>                                                      |
|---------------------------------------------|-----------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------|
| <b>MODULE – I</b><br>(Urochordata & Pisces) | 01                                            | 01                                            | 15                                                                                     |
| <b>MODULE – II</b><br>(Amphibia)            | 02                                            | 02                                            | 30                                                                                     |
| <b>MODULE – III</b><br>(Reptilia)           | 01                                            | 02                                            | 20                                                                                     |
| <b>MODULE – IV</b><br>(Aves & Mammalia)     | 02                                            | 02                                            | 30                                                                                     |
| <b>Total No. of Questions</b>               | <b>06</b><br><b>Of which 3 to be answered</b> | <b>07</b><br><b>Of which 4 to be answered</b> | <b>95</b><br><b>Marks including choice.</b><br><b>Of which 50 Marks to be answered</b> |

**NOTE: The question paper setters are requested to kindly adhere to the format given in the above table.**

**I B.Sc., (BZC), SEMESTER-II**  
(WITH EFFECTIVE FROM 2021-2022)  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**  
**PRACTICAL SYLLABUS**

**Learning Outcomes:**

- To understand the taxidermic and other methods of preservation of chordates
- To identify chordates based on special identifying characters
- To understand internal anatomy of animals through demo or virtual dissections, thus directing the student for “empathy towards the fellow living beings”
- To maintain a neat, labeled record of identified museum specimens

**I. Dissections-**

Scoliodon III, VII, IX and X Cranial nerves (Only Demonstration

Mounting of fish scales

**III Identification of slides/spotters**

1. Protochordata :*Herdmania, Amphioxus, Amphioxus* T.S through pharynx.
2. Cyclostomata :*Petromyzon and Myxine*.
3. Pisces :*Pristis, Torpedo, Hippocoampus, Exocoetus, Echeneis, Labeo, Catla, Clarius, Channa, Anguilla*.
4. Amphibia :*Ichthyophis, Amblystoma, Axolotl larva, Hyla*,
5. Reptilia: *Draco, Chamaeleon, Uromastix, Testudo, Trionyx, Russels viper, Naja, Krait, Hydrophis, Crocodile*.
6. Aves :*Psittacula, Eudynamis, Bubo, Alcedo*.
7. Mammalia: *Ornithorhynchus, Pteropus, Funambulus*.

**REFERENCE BOOKS:**

1. S.S.Lal, Practical Zoology – Vertebrata
2. P.S.Verma, A manual of Practical Zoology – Chordata

**I B.Sc., (BZC), SEMESTER-II**  
**(WITH EFFECTIVE FROM 2021-2022)**  
**TITLE: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**  
**PRACTICAL MODEL PAPER**

**(AT THE END OF II-SEMESTER-EFFECTIVE FROM 2017-18)**

**Max marks: 50**

**Time : 2Hrs**

1. Dissect and display the III & VII cranial nerves of Scoliodon. Draw a neat labelled diagram

10M

2. Identification of 5 spotters

4 X5=20M

A).....

B).....

C).....

D).....

E).....

3. Record

05M

4. Internal Assessment

15M

**Total 50M**

**Question Bank**  
**Animal diversity – II**  
**BIOLOGY OF CHORDATES**

**Essay question**

**Module – I**

1. Write an essay on the General Chordates of chordates
2. What is retrogressive metamorphosis? Discuss with special reference to the life history of an Ascidian and write its significance.
3. Life history of Herdmania.

**Module – II**

4. Explain migration in fishes.
5. Scoliodon respiratory system.
6. Write about the different sense organs in Scoliodon.
7. Respiratory system in Rana.
8. Reproductive system in Rana.

**Module - III**

9. Describe the structure and functions of Calotes digestive system.
10. Urinogenital system of Calotes
11. Identification of poisonous snakes.

**Module - IV**

12. Write about exoskeleton of Columbalivia.
13. Explain various flight adaptations in birds.
14. Explain respiratory system in birds.
15. Explain migration in birds
16. Write essay on dentition in mammals.

**SHORT ANSWERS**

**Module – I**

1. Salient features of Urochordata
2. Salient features of Cephalochordata.
3. Salient features of Cyclostomes
4. Structure of Herdmania

**Module – II**

5. Dipnoi
6. Scales in fishes.
7. Ampulla of Lorenzini
8. Buccopharyngeal respiration in frog.
9. Brain of Frog

**Module - III**

10. General characters of Reptilia.
11. Digestive glands of Calotes.
12. Calotes brain.
13. Urinogenital system of male Calotes.

**Module - IV**

14. Quill feathers.
15. General characters of mammals.
16. Pigeon heart.
17. Air sacs.
18. Syrinx in birds.
19. Protheria.

20. Metatheria

21. Eutheria

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**  
**DEPARTMENT OF ZOOLOGY**  
**w.e.f. 2020-21 (Revised in November -2021)**  
**ZOOLOGY – SEMESTER III**  
**PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND**  
**EVOLUTION**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

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**Course Outcomes:**

The overall course outcome is that the student shall develop deeper understanding of what life is and how it functions at cellular level. This course will provide students with a deep knowledge in Cell Biology, Animal Biotechnology and Evolution and by the completion of the course the graduate shall able to –

- C01** To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.
- C02** Describe fine structure and function of plasma membrane and different cell organelles of eukaryotic cell.
- C03** To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes, various types of inheritance patterns existing in animals
- C04** Acquiring in-depth knowledge on various of aspects of genetics involved in sex determination, human karyotyping and mutations of chromosomes resulting in various disorders
- C05** Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins.
- C06** Understand the principles and forces of evolution of life on earth, the process of evolution of new species and apply the same to develop new and advanced varieties of animals for the benefit of the society

## **Learning Objectives**

- To understand the origin of cell and distinguish between prokaryotic and eukaryotic cell
- To understand the role of different cell organelles in maintenance of life activities
- To provide the history and basic concepts of heredity, variations and gene interaction
- To enable the students distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance.
- To acquaint student with basic concepts of molecular biology as to how characters are expressed with a coordinated functioning of replication, transcription and translation in all living beings
- To provide knowledge on origin of life, theories and forces of evolution
- To understand the role of variations and mutations in evolution of organisms

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**ZOOLOGY SYLLABUS FOR III SEMESTER**

**PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY  
AND EVOLUTION**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

---

**Module – I Cell Biology**

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus
- 1.2 Electron microscopic structure of animal cell
- 1.3 Structure of Plasma membrane – Fluid mosaic model and transport functions
- 1.4 Structure and functions of Endoplasmic Reticulum, Mitochondria and Chromosomes

**Module – II Genetics - I**

- 2. 1 Mendel's Laws of Inheritance
- 2. 2 Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes
- 2. 3 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)
- 2. 4 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

**Module - III Genetics – II & Molecular Biology**

- 3.1 Chromosomal Disorders (Autosomal and Allosomal), Human Karyotyping
- 3.2 Basics on Genomics and Proteomics
- 3.3 DNA replication
- 3.4 Gene Expression in prokaryotes (Lac Operon), Gene Expression in eukaryotes

**Module – IV Evolution**

- 4.1 Origin of life
- 4.2 Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation theory
- 4.3 Neo-Darwinism: Modern Synthetic theory of Evolution, Hardy-Weinberg Equilibrium
- 4.4 Forces of Evolution: Isolation, Speciation

**Additional Module**

- Models of Plasma membrane – Bilamellar, Micellar and Unit Membrane
- Golgi complex, Lysosomes and Ribosomes

- Multiple Alleles -Blood group inheritance
- Genetic Drift, Natural Selection,

### **Co-curricular activities (Suggested)**

- Model of animal cell
- Working model of mitochondria to encourage creativity among students
- Photo album of scientists of cell biology
- Charts on plasma membrane models/cell organelles
- Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
- Observation of blood group inheritance in students, from their parents and grand parents
- Karyotyping and preparation of pedigree charts for identifying diseases in family history
- Charts on chromosomal disorders
- Charts on central dogma/lac operon/genetic code
- Model of semi-conservative model of DNA replication
- Model of tRNA and translation mechanism
- Power point presentation of transcription or any other topic by students
- Draw geological time scale and highlight important events along the time line
- Chart on industrial melanism to teach directed selection, Darwin's finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.

# **QUESTION BANK FOR CYTOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION**

## **MODULE -I**

### **Essay Questions**

1. Write notes on prokaryotes and eukaryotes
2. Structure and functions of plasma membrane
3. Explain structure and functions of Endoplasmic Reticulum
4. Structure and Types of Chromosomes

### **Short Answer Question**

1. Prokaryotes
2. eukaryotes
3. Virus
4. Fluid Mosaic model
5. Mitochondria
6. Nucleus

## **MODULE II**

### **Essay Questions**

1. Mendel's laws of inheritance
2. Write an essay on incomplete dominance and co-dominance
3. Explain the law of independent assortment with suitable examples
4. Explain sex determination in animal kingdom
5. Give an account on X Linked inheritance

### **Short Answer Questions**

1. Law of segregation
2. Epistasis
3. Y linked inheritance
4. Genic balance theory
5. sex determination in Human beings
6. XY linked inheritance

## **MODULE III**

### **Essay Questions**

1. Write an essay on Autosomal disorders in human beings
2. Describe the process of DNA replication
3. Explain the concept of Lac operon in detail
4. Write an essay on Gene expression in Eukaryotes

### **5. Short Answer Questions**

1. Edward's Syndrome
2. Turner syndrome
3. Klinefelter syndrome
4. Genomics
5. lac operon

## **MODULE IV**

### **Essay Questions**

1. Explain the origin of life in the evolutionary process
2. Write an essay on Darwinism
4. Write an essay on Isolation
3. What is speciation? Write an essay on types of speciation.

### **Short Answer Questions**

1. Miller and Urey experiment
2. Lamarckism
3. NeoDarwinism
4. Hardy-Weinberg law
5. Germ plasm theory

## REFERENCES:

1. Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell 'Molecular Cell Biology' W.H.Freeman and company New York.
2. Cell Biology by De Robertis
3. Bruce Alberts, Molecular Biology of the Cell
4. Rastogi, Cytology
5. Varma & Aggarwal, Cell Biology
6. C.B. Powar, Cell Biology
7. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
8. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
9. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
10. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
11. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
12. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
13. Molecular Biology by freifielder
14. Instant Notes in Molecular Biology by Bios scientific publishers and Viva Books Private Limited
15. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
16. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
17. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
18. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley.
19. James D. Watson, Nancy H. Hopkins 'Molecular Biology of the Gene'
20. Jan M. Savage. Evolution, 2nd ed, Oxford and IBH Publishing Co., New Delhi.
21. Gupta P.K., 'Genetics

**II B.Sc., (BZC), SEMESTER-III**  
**ZOOLOGY SYLLABUS**  
(WITH EFFECTIVE FROM 2020-2021)  
**AT THE END OF SEMESTER-III**  
**Blue print for CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY**  
**AND EVOLUTION**

| Module Name    | PART I<br>Essay Type<br>Questions<br>10 marks<br>each | PART I I<br>Short answer<br>Questions<br>5 marks each | Marks Allotted<br>to the<br>Chapter                                            |
|----------------|-------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------|
| 1.Cellbiology  | 1                                                     | 2                                                     | 20                                                                             |
| 2. Genetics I  | 2                                                     | 3                                                     | 35                                                                             |
| 3. Genetics II | 1                                                     | 3                                                     | 25                                                                             |
| 4.Evolution    | 2                                                     | 2                                                     | 30                                                                             |
| 5.Total        | 6<br>Of which 3<br>to be<br>answered                  | 10<br>Of which 6 to be<br>answered                    | 110 Marks<br>including<br>choice.<br>Of which 60<br>Marks to<br>be<br>answered |

**ZOOLOGY MODEL PAPER FOR III SEMESTER**

**ZOOLOGY - PAPER - III**

**CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND  
EVOLUTION**

**Time : 2 ½ hrs**

**Max. Marks :60**

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**PART - 1**

**Note :Answer any THREE questions choosing at least one question from each section. Draw the diagrams wherever necessary**

**3 X10 = 30**

**SECTION- A**

1. Write an essay on structure and functions of plasma membrane
2. Explain the role of chromosomes in sex determination
3. Describe X linked inheritance

**SECTION-B**

4. Write an essay on gene expression in eukaryotes
5. Write an essay on Darwinism
6. Write an essay on Speciation

**Part - II**

**Answer any Six questions**

**6x5=30**

7. Prokaryotic cell
8. Mitochondria
9. Genic balance theory
10. Incomplete Dominance
11. Y linked inheritance
12. Turner syndrome
13. Genomics
14. Lac operon
15. Hardy-Weinberg law
16. NeoDarwinism

## **ZOOLOGY PRACTICAL SYLLABUS FOR III**

### **SEMESTER ZOOLOGY - PAPER - III**

#### **CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION**

**Periods: 24**

**Max. Marks: 50**

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#### **Learning Objectives:**

- Acquainting and skill enhancement in the usage of laboratory microscope
- Hands-on experience of different phases of cell division by experimentation
- Develop skills on human karyotyping and identification of chromosomal disorders
- To apply the basic concept of inheritance for applied research
- To get familiar with phylogeny and geological history of origin & evolution of animals

#### **I. Cell Biology**

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 and problems
2. Problems on blood group inheritance and sex linked inheritance
3. Study of human karyotypes (Down's syndrome, Edwards syndrome, Turner's syndrome and Klinefelter syndrome)

#### **III. Evolution**

1. Study of homology and analogy from suitable specimens and pictures
2. Phylogeny of horse with pictures
3. Study of Genetic Drift by using examples of Darwin's finches (pictures)

## REFERENCE BOOKS

1. Burns GW. 1972. *The Science of Genetics. An Introduction to Heredity*. Mac Millan Publ. Co.Inc.
2. Gardner EF. 1975. *Principles of Genetics*. John Wiley & Sons, Inc. New York.
3. Harth and Jones EW. 1998. *Genetics - Principles and Analysis*. Jones and BarHett Publ. Boston.
4. Levine L. 1969. *Biology of the Gene*. Toppan.
5. Pedder IJ. 1972. *Genetics as a Basic Guide*. W. Norton & Company, Inc.
6. Rastogi VB. 1991. *A Text Book of Genetics*. KedarNath Ram Nath Publications, Meerut, Uttar Pradesh, India.
7. Rastogi VB. 1991. *Organic Evolution*. KedarNath Ram Nath Publications, Meerut, Uttar Pradesh, India.
8. Stahl FW. 1965. *Mechanics of Inheritance*. Prentice-Hall.
9. White MJD. 1973. *Animal Cytology and Evolution*. Cambridge Univ.Press.

**II B.Sc., (BZC), SEMESTER-III**  
**ZOOLOGY - PAPER – III (At the End of III semester)**  
**PRACTICAL MODEL PAPER**  
**CELL BIOLOGY, GENETICS , MOLECULOR BIOLOGYand EVOLUTION**

**Max marks: 50**

**Time : 2Hrs**

1. Prepare temporary slides of Mitotic divisions with onion root tips      10M
2. Identification of 5spotters/Genetic Problems      5 X5=25M
  - A) (Cytology)
  - B) (Genetics)
  - C) (Genetics)
  - D) (Evolution)
  - E) (Evolution)
3. Record      05M
4. Internal assessment      10M
- Total      50M**

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**ZOOLOGY – SEMESTER IV**

**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**HOURS : 60**

**Max. Marks: 60**

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**Course Outcomes:**

- This course will provide students with a deep knowledge in Physiology, Cellular metabolism and Molecular Biology and by the completion of the course the graduate shall able to –

CO1: Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.

CO2: Understand the muscular system and the neuro-endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.

CO3: Describe the structure, classification and chemistry of biomolecules and enzymes responsible for sustenance of life in living organisms

CO4: Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules

CO5: Describe the key events in early embryonic development starting from the formation of gametes up to gastrulation and formation of primary germ layers.

**Learning Objectives**

- To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals.
- To instill the concept of hormonal regulation of physiology, metabolism and reproduction in animals.
- To understand the disorders associated with the deficiency of hormones
- To demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- To provide insightful knowledge on the structure and classification of carbohydrates, proteins, lipids and enzymes
- To demonstrate an understanding of fundamental biochemical principles such as the function of biomolecules, metabolic pathways and the regulation of biochemical processes
- To make students gain proficiency in laboratory techniques in biochemistry and orient them to apply the scientific method to the processes of experimentation and hypothesis testing.

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**ZOOLOGY SYLLABUS FOR IV SEMESTER**

**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**HOURS: 60 Max. Marks: 100**

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|               |                              |               |
|---------------|------------------------------|---------------|
| <b>UNIT I</b> | <b>Animal Physiology – I</b> | <b>15 hrs</b> |
|---------------|------------------------------|---------------|

- 1.1 Process of digestion and assimilation
- 1.2 Respiration - Pulmonary ventilation, transport of oxygen and CO<sub>2</sub>  
(Note: Need not study cellular respiration here)
- 1.3 Circulation - Structure and functioning of heart, Cardiac cycle
- 1.4 Excretion - Structure and functions of kidney urine formation, counter current Mechanism

|                |                               |               |
|----------------|-------------------------------|---------------|
| <b>UNIT II</b> | <b>Animal Physiology – II</b> | <b>20 hrs</b> |
|----------------|-------------------------------|---------------|

- 2.1 Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers
- 2.2 Muscle contraction - Ultra structure of muscle, molecular and chemical basis of muscle contraction
- 2.3 Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas
- 2.4 Hormonal control of reproduction in a mammal

|                 |                            |               |
|-----------------|----------------------------|---------------|
| <b>UNIT III</b> | <b>Cellular Metabolism</b> | <b>10 hrs</b> |
|-----------------|----------------------------|---------------|

- 3.1 Carbohydrates - Classification of carbohydrates. Structure of glucose
- 3.2 Proteins - Classification of proteins. General properties of amino acids
- 3.3 Lipids - Classification of lipids
- 3.4 Enzymes: Classification and Mechanism of Action of enzymes

|                |                   |               |
|----------------|-------------------|---------------|
| <b>UNIT IV</b> | <b>Embryology</b> | <b>10 hrs</b> |
|----------------|-------------------|---------------|

- 4.1 Gametogenesis
- 4.2 Fertilization
- 4.3 Types of eggs
- 4.4 Types of cleavages
- 4.5 Development of Frog up to formation of primary germ layers

## Co-curricular activities (Suggested)

- Chart on cardiac cycle, human lung, kidney/nephron structure etc.
- Working model of human / any mammalian heart.
- Chart of sarcomere/location of endocrine glands in human body
- Chart affixing of photos of people suffering from hormonal disorders
- Student study projects such as identification of incidence of hormonal disorders in the local primary health centre, studying the reasons thereof and measures to curb or any other as the lecturer feels good in nurturing health awareness among students
- Chart on structures of biomolecules/types of amino acids (essential and non-essential)Chart preparation by students on Glycolysis / kreb's cycle/urea cycle etc.
- Model of electron transport chain
- Preparation of models of different types of eggs in animals
- chart on frog embryonic development, fate map of frog blastula, cleavage etc.

## REFERENCE BOOKS

1. Eckert H. Animal Physiology: Mechanisms and Adaptation. W.H. Freeman & Company.
2. Floray E. An Introduction to General and Comparative Animal Physiology. W.B. SaundersCo., Philadelphia.
3. Goel KA and Satish KV. 1989. A Text Book of Animal Physiology, Rastogi Publications, Meerut, U.P.
4. Hoar WS. General and Comparative Physiology. Prentice Hall of India, New Delhi.
5. Lehninger AL. Nelson and Cox. Principles of Biochemistry. Lange MedicalPublications, New Delhi.
6. Prosser CL and Brown FA. Comparative Animal Physiology. W.B. SaundersCompany, Philadelphia.
7. Developmental Biology by Balinsky
8. Developmental Biology by Gerard Karp
9. Chordate embryology by Varma and Agarwal
10. Embryology by V.B. Rastogi
11. Austen CR and Short RV. 1980. Reproduction in Mammals. Cambridge University Press.
12. Gilbert SF. 2006. Developmental Biology, 8th Edition. Sinauer Associates Inc., Publishers,Sunderland, USA.

13. Longo FJ. 1987. Fertilization. Chapman & Hall, London.
14. Rastogi VB and Jayaraj MS. 1989. Developmental Biology. KedaraNath Ram Nath Publishers, Meerut, Uttar Pradesh.
15. Schatten H and Schatten G. 1989. Molecular Biology of Fertilization. Academic Press, New York

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**II B.Sc., (BZC), SEMESTER-IV ZOOLOGY SYLLABUS**

**(WITH EFFECTIVE FROM 2020-2021) AT THE END OF IV SEMESTER**

**Blue print for PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

| Module Name                      | PART I<br>Essay Type<br>Questions<br>10 marks each | Part II Short<br>Answer<br>Questions<br>5 marks each | Marks Allotted to<br>the Chapter                                         |
|----------------------------------|----------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------|
| <b>1. Animal Physiology - I</b>  | 1                                                  | 03                                                   | 25                                                                       |
| <b>2. Animal Physiology - II</b> | 2                                                  | 02                                                   | 30                                                                       |
| <b>3. Cellular Metabolism</b>    | 1                                                  | 03                                                   | 25                                                                       |
| <b>4. Embryology</b>             | 2                                                  | 02                                                   | 30                                                                       |
| <b>5.Total</b>                   | 06<br>Of which 3 to<br>be answered                 | 10<br>Of which 6 to be<br>answered                   | 110 Marks<br>including choice.<br>Of which 60<br>Marks to be<br>answered |

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**MODEL PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM  
AND EMBRYOLOGY**

**PART-I**

Answer any THREE questions choosing at least one question from each section

All questions carry equal marks

3 x 10 = 30 Marks

**SECTION – A**

1. Write an essay on Urine formation
2. Describe Muscle contraction mechanism
3. Describe the hormonal control of reproduction of mammals

**SECTION -B**

4. Explain mechanism of enzyme action
5. Describe the process of spermatogenesis
6. Describe in detail the development of frog up to gastrulation level?

**PART-II**

Answer any six of the following

6 x 5 = 30 Marks

7. Oxygen transport
8. Cardiac cycle
9. Digestion in stomach
10. Action Potential
11. Thyroid gland
12. Classification of proteins
13. Lipid structure
14. Glucose structure
15. Fate maps
16. Types of eggs

**&&&&&&&**

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**MODEL PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM  
AND EMBRYOLOGY**

**MODEL QUESTIONS**

**Module I:**

**Essay Questions:**

1. Describe the process of digestion in detail
2. Write an essay on the transport of respiratory gases
3. Structure and function of heart
4. Urine formation

**Short Answer Questions:**

1. Assimilation of food
2. Oxygen dissociation curve
3. Co<sub>2</sub> Transport
4. Cardiac Cycle
5. Counter Current Mechanism
6. Protein digestion
7. Digestion in mouth
8. Digestion in stomach
9. Structure of Kidney

**MODEL QUESTIONS**

**Module II:**

**Essay Questions:**

1. Describe the process of Nerve impulse transmission
2. Molecular basis of Muscle contraction
3. Sliding filament theory of muscle contraction
4. Detailed ultra-structure of muscle
5. Hormones of pituitary gland
6. Hormonal control of reproduction in a mammal

**Short Answer Questions:**

1. Resting potential
2. Action potential
3. Synaptic transmission
4. Sarcomere
5. Muscle proteins
6. Pancreas
7. Thyroid

8. Adrenal gland
9. Testis

## **MODEL QUESTIONS**

### **Module III:**

#### **Essay Questions:**

1. Classification of Carbohydrates
2. Structure of glucose
3. Classification of Protein
4. Properties of Amino acids
5. Classification of lipids
6. Classification of Lipids
7. Details of enzyme activity

#### **Short Answer Questions:**

1. Glucose properties
2. Starch
3. Cellulose
4. Primary protein
5. Properties of Amino acids
6. Steroids
7. Lock and Key model

## **MODEL QUESTIONS**

### **Module IV:**

#### **Essay Questions:**

1. Write an essay on spermatogenesis
2. Describe the process of oogenesis
3. Describe the types of cleavages
4. Write an essay on the development of frog up to gastrulation level

#### **Short Answer Questions:**

1. Spermatogenesis vs spermiogenesis
2. Oogonia
3. Structure of Sperm
4. Fertilization
5. Fertilin- antifertilin activity
6. Types of eggs
7. Cleavage principles
8. Fate maps

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**II B.Sc., (BZC), SEMESTER-IV ZOOLOGY PRACTICALSYLLABUS**

**ZOOLOGY - PAPER - IV**

**ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**Periods: 24**

**Max. Marks: 50**

**Learning Objectives:**

- Identification of an organ system with histological structure
- Deducing human health based on the information of composition of blood cells
- Demonstration of enzyme activity in vitro
- Identification of various biomolecules of tissues by simple colorimetric methods and also quantitative methods
- Identification of different stages of earl embryonic development in animals
- ANIMAL PHYSIOLOGY
  - Qualitative tests for identification of carbohydrates, proteins and fats
  - Study of activity of salivary amylase under optimum conditions
  - T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
  - Differential count of human blood
- CELLULAR METABOLISM
  - Estimation of total proteins in given solutions by Lowry's method.
  - Estimation of total carbohydrate by Anthrone method.
  - Qualitative tests for identification of ammonia, urea and uric acid
- EMBRYOLOGY
  - Study of T.S. of testis, ovary of a mammal

- Study of different stages of cleavages (2, 4, 8 cell stages)
- Construction of fate map of frog blastula

- **REFERENCE BOOKS:**

- Harper's Illustrated Biochemistry
- Cell and molecular biology: Concepts & experiments. VI Ed. John Wiley & sons. Inc.
- Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Laboratory techniques by Plummer

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**ZOOLOGY - PAPER – IV PRACTIAL MODEL PAPER**

**ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND**

**EMBRYOLOGY Periods: 24**

**Max. Marks: 50**

|                                                                 |                 |
|-----------------------------------------------------------------|-----------------|
| 1. Salivary amylase activity experiment with detailed procedure | 12 Marks        |
| 2. Test for Ammonia                                             | 08 Marks        |
| 3. Embryology slide 2 x 5                                       | 10 Marks        |
| a.                                                              |                 |
| b.                                                              |                 |
| 4. Physiology Slides: 2x5                                       | 10 Marks        |
| a.                                                              |                 |
| b.                                                              |                 |
| 5. Record                                                       | 05 Marks        |
| 6. Viva voce                                                    | 05 Marks        |
| Total                                                           | <b>50 Marks</b> |

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**II B.Sc., (BZC), SEMESTER-IV**

**ZOOLOGY SYLLABUS SEMESTER IV**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS: 60**

**Max. Marks: 60**

**Course Outcomes:**

This course will provide students with a deep knowledge in immunology, genetics, embryology and ecology and by the completion of the course the graduate shall be able to –

CO1 To get knowledge of the organs of Immune system, types of immunity, cells and organs of immunity.

CO2 To describe immunological response as to how it is triggered (antigens) and regulated (antibodies)

CO3 Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.

CO4 Get familiar with the tools and techniques of animal biotechnology.

**Learning Objectives**

- To trace the history and development of immunology
- To provide students with a foundation in immunological processes
- To be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major Histocompatibility Complex in terms of immune response and transplantation
- To provide knowledge on animal cell and tissue culture and their preservation

To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms

- To explain in vitro fertilization, embryo transfer technology

and other reproduction manipulation methodologies.

- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
- To understand principles of animal culture, media preparation.

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**II B.Sc., (BZC), SEMESTER-IV**

**ZOOLOGY SYLLABUS**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60**

**Max. Marks:**

**100**

**Unit – I            Immunology – I (Overview of Immune system) 15 hrs**

- 1.1      Introduction to basic concepts in Immunology
- 1.2      Innate and adaptive immunity, Vaccines and Immunization programme
- 1.3      Cells of immune system
- 1.4      Organs of immune system

**Unit – II            Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity) 15 hrs**

- 2.1      Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants; Factors influencing immunogenicity
- 2.2      Antibodies: Structure of antibody, Classes and functions of antibodies
- 2.3      Structure and functions of major histocompatibility complexes
- 2.4      Exogenous and Endogenous pathways of antigen presentation and processing
- 2.5      Hypersensitivity – Classification and Types

**Unit – III            Biotechnology Techniques 15hrs**

- 3.1      Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
- 3.2      Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Organ culture; Cryopreservation of cultures
- 3.3      Stem cells: Types of stem cells and applications
- 3.4      Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

**Unit – IV            Applications of Animal Biotechnology 15 hrs**

- 4.1      Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology

- 4.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery
- 4.3 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; Applications
- 4.4 PCR: Basics of PCR.-DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)

#### **Co-curricular activities (suggested)**

- Organizing awareness on immunization importance in local village in association with
- NCC and NSS teams
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students
- Visit to research laboratory in any University as part of Zoological tour and exposure and/or hands-on training on animal cell culture.
- Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishes etc.

#### **REFERENCE BOOKS**

1. Immunology by Ivan M. Riott
2. Immunology by Kubey
3. Sreekrishna V. 2005. Biotechnology –I, Cell Biology and Genetics. New Age International  
Publ.New Delhi, India.

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**DEPARTMENT OF ZOOLOGY**  
**w.e.f. 2020-21 (Revised in November -2021)**  
**II B.Sc., (BZC), SEMESTER-IV ZOOLOGY SYLLABUS**  
**(WITH EFFECTIVE FROM 2020-2021) AT THE END OF SEMESTER IV**  
**Blue print for PAPER – V**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

| Module Name                                                                            | PART I<br><br>Essay Type<br>Questions<br><br>10 marks each | Part II Short<br>Answer<br>Questions<br><br>5 marks each | Marks Allotted<br>to the Chapter                                                |
|----------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>1. Immunology – I<br/>(Overview of<br/>Immune system)</b>                           | 1                                                          | 03                                                       | 25                                                                              |
| <b>2. Immunology – II<br/>(Antigens,<br/>Antibodies, MHC and<br/>Hypersensitivity)</b> | 2                                                          | 02                                                       | 30                                                                              |
| <b>3. Biotechnology<br/>Techniques</b>                                                 | 1                                                          | 03                                                       | 25                                                                              |
| <b>4. Applications of<br/>Animal<br/>Biotechnology</b>                                 | 2                                                          | 02                                                       | 30                                                                              |
| <b>5.Total</b>                                                                         | 06<br><br>Of which 3 to be<br>answered                     | 10<br><br>Of which 6 to be<br>answered                   | 110 Marks<br>including<br>choice.<br><br>Of which 60<br>Marks to be<br>answered |

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**  
**DEPARTMENT OF ZOOLOGY**  
**w.e.f. 2020-21 (Revised in November -2021)**  
**II B.Sc., (BZC), SEMESTER-IV ZOOLOGY**  
**MODEL PAPER – V**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**PART-I**

Answer any THREE questions choosing at least one question from each section  
All questions carry equal marks 3 x 10 = 30 Marks

**SECTION – A**

- 17. Write an essay on the cells of Immune system
- 18. Describe various classes of Antibodies
- 19. Explain in detail exogenous path way of antigen presentation

**SECTION -B**

- 20. Explain media preparation in detail
- 21. Describe the Restriction endonucleases
- 22. What is the application of transgenic animals and give examples?

**PART-II**

Answer any six of the following 6 x 5 = 30 Marks

- 23. Adaptive immunity
- 24. Thymus gland
- 25. Spleen
- 26. Epitope
- 27. Paratope
- 28. Tissue culture media
- 29. Primary cell culture
- 30. MABs
- 31. Plasmid vector
- 32. DNA sequencing technique

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**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**  
**DEPARTMENT OF ZOOLOGY**  
**w.e.f. 2020-21 (Revised in November -2021)**  
**II B.Sc., (BZC), SEMESTER-IV ZOOLOGY**  
**MODEL PAPER – V**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**  
**Model Questions**

**Module I**

**Essay questions:**

1. Over view of immune system
2. Innate immunity
3. Adaptive immunity
4. Cells of immune system
5. Organs of immune system

**Short Answer Questions:**

1. Immunology concept
2. Vaccination programme
3. T Cells
4. B Cells
5. Spleen
6. Bone marrow
7. Macrophages
8. Primary lymphoid organs

**MODULE II**

**Essay Questions**

1. Properties of Antigens
2. Factors influencing the immunogenicity
3. Structure of Antibody
4. Classes of Antibodies
5. MHC structure
6. Exogenous path way of Antigen presentation
7. Endogenous path way of Antigen presentation
8. Hypersensitivity types

**Short Answer Questions:**

1. Epitope
2. Heptane
3. Adjuvants
4. Ig M
5. Ig G
6. Ig E
7. Functions of MHC
8. Type I Hyper sensitivity
9. APC mechanism

## **MODULE III**

### **Essay Questions**

1. Culture media preparation
2. Natural culture media
3. Synthetic culture media
4. Primary cell culture
5. Stem cells – types- applications
6. Hybridoma technology

### **Short Answer Questions:**

1. Tissue culture applications
2. Properties of culture medium
3. Cell line types
4. Organ culture concept
5. Cryopreservation
6. MABS
7. Stem cell-types
8. Stem cell- Applications

## **MODULE IV**

### **Essay Questions**

1. rDNA Technology applications
2. Restriction endonucleases
3. Types of vectors used in Genetic engineering
4. Gene delivery techniques
5. Transgenic animals – applications- examples
6. DNA sequencing mechanism

### **Short Answer Questions:**

1. Plasmid
2. Cosmid
3. Type II restriction endonucleases
4. Gene gun
5. Microinjection techniques
6. Liposome
7. Transgenic fish
8. PCR principle
9. Automated sequencing

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**  
**DEPARTMENT OF ZOOLOGY**  
**w.e.f. 2020-21 (Revised in November -2021)**  
**II B.Sc., (BZC), SEMESTER-IV**  
**ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER COURSE – 5**  
**IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

Periods: 24

Max. Marks: 50

**Learning Objectives:**

- Acquainting student with immunological techniques vis-à-vis theory taught in the class room
- Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
- Demonstrate basic laboratory skills necessary for Biotechnology research
- Promoting application of the lab techniques for taking up research in higher studies

**I. IMMUNOLOGY**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of a. ELISA
5. Immuno electrophoresis

**II. Animal biotechnology**

1. DNA quantification using DPA Method.
2. Separation, Purification of biological compounds by paper chromatography
3. Preparation of culture media.

**REFERENCE BOOKS**

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson2. Practical Immunology A Laboratory Manual; LAP LAMBERT Academic Publishing
3. Manual of laboratory experiments in cell biology by Edward, G
4. Laboratory Techniques by Plummer

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**  
**DEPARTMENT OF ZOOLOGY**  
**w.e.f. 2020-21 (Revised in November -2021)**  
**II B.Sc., (BZC), SEMESTER-IV**  
**ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER COURSE – 5**  
**IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

Periods: 24

Max. Marks: 50

Time 2 Hrs

**Practical Examination Model paper**

|                              |       |          |
|------------------------------|-------|----------|
| 1. Paper chromatography      |       | 15 Marks |
| 2. Blood Group determination |       | 10 Marks |
| 3. Slides A                  |       |          |
| Slide B                      |       |          |
| Slide C                      | 3 x 5 | 15 Marks |
| 4. Record                    |       | 05 Marks |
| 5. Viva Voce                 |       | 05 Marks |
| Total                        |       | 50 Marks |

**(WITH EFFECTIVE FROM 2020-2021)**  
**SEMESTER-V CODE ZO 5508-C**

**ZOOLOGY - PAPER - VI ANIMAL HUSBANDRY**

CREDITS: 3T+2P  
P/week

Hrs : 3 T+ 2

| OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                       | LEARNING OUTCOMES                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• To give general introduction to poultry farming, management of chicks</li><li>• to make the student understand the feed management techniques in poultry industry.</li><li>• To impart knowledge and skill in handling of hatching eggs, breeding</li><li>• Imparts knowledge on the breeds of dairy cattle buffaloes and their classification</li></ul> | <ul style="list-style-type: none"><li>• Familiar with introduction to poultry farming, Management of chicks</li><li>• Understand the principles of feeding, Nutrient requirements and Poultry diseases</li><li>• Gains knowledge in methods of hatching, brooding and sexing of chicks</li><li>• Be able to distinguish between breeds of cattle, Classification. Gains knowledge in selection of site for dairy farm, weaning of calf</li></ul> |

**Module – I**

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

**Module– II:**

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.

**Module– III:**

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

**Module-IV:**

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

BLUE PRINT

III Year B.Sc.,Zoology

SEMESTER-V CODE ZO 5508-C

**ZOOLOGY - PAPER - VI ANIMAL HUSBANDRY**  
**At the end of V Semester Under CBCS Pattern**

| <b>Module</b> | <b>PART I<br/>Essay Type<br/>Questions 10<br/>marks each</b> | <b>Part II Short<br/>Answer<br/>Questions<br/>5 marks each</b> | <b>Marks Allotted to<br/>the Chapter</b>                                                                              |
|---------------|--------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Module - I    | 1                                                            | 03                                                             | 25                                                                                                                    |
| Module - II   | 2                                                            | 02                                                             | 30                                                                                                                    |
| Module - III  | 1                                                            | 03                                                             | 25                                                                                                                    |
| Module - IV   | 2                                                            | 02                                                             | 30                                                                                                                    |
| <b>Total</b>  | <b>06</b><br><b>Of which 3 to be<br/>answered</b>            | <b>10</b><br><b>Of which 6 to be<br/>answered</b>              | <b>110 Marks</b><br><b>including</b><br><b>choice.</b><br><b>Of which 60</b><br><b>Marks to be</b><br><b>answered</b> |

**NOTE: The question paper setters are requested to kindly adhere to the format given in the abovetable.**

SEMESTER-VI  
ZOOLOGY - PAPER – VI(Effective from 2020-202120)

ANIMAL HUSBANDRY

MODEL QUESTION PAPER  
Time: 2½hrs.      Max Marks: 60

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**PART – 1**

**Note :Answer any THREE questions choosing at least one question from each section. Draw the diagrams whereevernecessary 3 X10 = 30**

**SECTION- A**

1. Write an essay on management practices in poultry.
2. Describe the various ingredients of poultry feed.
3. Explain various viral diseases in poultry industry

**SECTION-B**

4. Describe the various methods of hatching of eggs.
5. Describe the various indigenous breeds of dairy cattle of india.
6. Describe the methods of vaccination for dairycattle.

**Part – II**

Answer any **Six** questions

**6x5=30**

7. Site selection for dairy farm
8. Brooding.
9. Cage system.
10. Gumborodisease.
11. Feeding of Calves
12. Selection ofeggs.
13. Exotic cattle breeds.
14. Culling.
15. Inbreeding.
16. Castration

## QUESTION BANK

### **Module – I Essay question**

1. Write an essay on Poultry housing systems.
2. Describe various Principles of Housing in poultry farm
3. What are the management practices followed in poultryfarms.
4. Describe the various implements used in poultrysheds.

### **Short answer questions**

1. selection of location for poultry farm
2. Debeaking
3. cannibalism
4. Medicines used in poultryshed
5. Cage system
6. Deep litter method
7. Poultry house dimensions and characters
8. Culling

### **Module - II Essay questions**

1. Describe the various ingredients of poultryfeed
2. Various viral diseases in poultrybirds
3. Fungal diseases in poultrybirds
4. Internal and external parasites in poultrybirds
5. Describe various methods of feeding

### **Short questions**

1. Gumboro disease.
2. Cholera
3. Ranikhet disease
4. Ticks and mites
5. Typhoid
6. pullorum

### **Module – III Essay questions**

1. Describe the process of selection of eggs for brooding and their precautions.
2. Describe the various methods of hatching of eggs.
3. What are the steps taken for hatching of eggs artificially in incubators.
4. What are the various brooding methods used in the rearing of chicks and their management practices.

### **Short questions**

1. Brooder rings
2. Candling test
3. Leghorn
4. Precautions to be taken during incubation of chicks

5. Selection of eggs
6. Sexing of chicks

## **Module – IV**

### **Essay questions**

1. What are the important aspects for the selection of dairy cattle.
2. Describe the various indigenous breeds of dairy cattle of India.
3. What is animal breeding, and its various methods.
4. Describe the construction of dairy farm.
5. Describe various records to be maintained in dairy farm.

### **Short answer questions**

1. Inbreeding
2. Outbreeding
3. Dehorning
4. Sanitation and hygiene in dairy farm.
5. Site selection for dairy.
6. Vaccination programme for dairy
7. Jersey cow
8. Murrah buffalo

**III Year B.Sc.,Zoology**

**ZOOLOGY - PAPER - VI ANIMALHUSBANDRY**

**CODE ZO 5508-CP**

**At the end of V Semester Under CBCS Pattern**

**PRACTICAL SYLLABUS**

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

**Model paper for Practical semester End Examination**

Max.Marks 50

Time: 2 Hours

- |    |                                                   |            |
|----|---------------------------------------------------|------------|
| 1. | Identify thefollowing spotters/Charts/Photographs | 30 M (6x5) |
| A  | Layer breed                                       |            |
| B. | Broiler Breed                                     |            |
| C. | Diseasepoultry                                    |            |
| D. | Disease Poultry                                   |            |
| E  | Diseasediary                                      |            |
| F. | Breed of cattle                                   |            |
| 2. | Record                                            | 05M        |
| 3. | Internal Assessment                               | 15 M       |

Total 50M

**Reference books**

1. A Textbook Of Animal Husbandry – by Banerjee G. C. (Author)
2. Principles Of Animal Nutrition And Feed Technology by REDDY D. V (Author)
3. Animal Genetics and Breeding bySukhvir Singh Tomar&Rajbeer S Tomar, Arun Kumar (Author)
4. Handbook of Agriculture- ICAR Publication

5. Livestock and poultry production – Harban Singh and Moore
6. Handbook of Animal Husbandary Hardcover by Aruna T. Kumar (Author)
7. outlines of Dairy: Technology Paperback by De Sukumar (Author)

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**w.e.f. 2020-21 (Revised in November -2021)**

**ZOOLOGY – SEMESTER VI**

**ELECTIVE PAPER – VII (A): IMMUNOLOGY**

**HOURS:60 (5X12)**

**Max.Marks:100**

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**Course Outcomes:**

The overall course outcome is that the student shall develop deeper understanding of what immune system is and how its functions. This course will provide students with a better knowledge on the overall view of the immune system and by the completion of the course the graduate shall be able to–

- CO1** To understand the basic concepts in Immune System, Innate and Adaptive immunity.
- CO2** Acquire knowledge on the various types of cells and organs of immune system .
- CO3** To understand basic properties of antigens. B and T Cells. Epitopes, Haptens and Adjuvants and the various factors that influence Immunogenicity.
- CO4** Acquiring knowledge on structure, classes and functions of anti-bodies and monoclonal anti-bodies.
- CO5** To understand the central dogma of major histocompatibility complexes, exogenous and endogenous pathway of antigen presentation and processing,
- CO6** To learn the various types of hypersensitivities, concept of auto-immunity, immunodeficiency and auto-immune diseases.
- CO7** To learn the various types of vaccines and the transplantation of immunology process.

## **Learning Objectives**

- To learn the various types of immune systems i.e innate and acquired immunity.
- To understand the role of different cell organelles of immune system.
- To get knowledge on basic properties of antigens.
- To study about B and T cell epitopes, haptens and adjuvants.
- To acquaint student with basic concepts on structure, classes and functions of anti-bodies and monoclonal anti-bodies.
- To provide knowledge on major histocompatibility complexes, exogenous and endogenous pathway of antigen presentation and processing.
- To learn the various types of hypersensitivities, concept of auto-immunity, immunodeficiency and auto-immune diseases.
- To understand the role of vaccines and their types.

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY  
SYLLABUS FOR VI SEMESTER ZOOLOGY  
PAPER: ELECTIVE VII (A)  
IMMUNOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**Module-I**

**1.1 *Overview of Immune System:***

- 1.1.1 Introduction to basic concepts in Immune System
- 1.1.2 Innate and adaptive immunity

**1.2 *Cells and Organs of Immune System:***

- 1.2.1 Cells of Immune system
- 1.2.2 Organs of Immune system

**Module-II**

**2.1 *Antigens:***

- 2.1.1 Basic properties of antigens
- 2.1.2 B and T cell epitopes, haptens and adjuvants
- 2.1.3 Factors influence immunogenicity

**2.2 *Anti bodies:***

- 2.2.1 Structure of antibody
- 2.2.2 Classes and functions of antibodies
- 2.2.3 Monoclonal antibodies

**Module- III**

**3.1 *Working of Immune system:***

- 3.1.1 Structure and functions of major histocompatibility complexes.
- 3.1.2 Exogenous pathway of antigen presentation and processing.
- 3.1.3 Endogenous pathway of antigen presentation and processing

**Module-IV**

**4.1 *Immune system in health and disease:***

- 4.1.1 Classification and brief description of various types of hypersensitivities.
- 4.1.2 Introduction to concepts of autoimmunity
- 4.1.3 Immunodeficiency and auto immune Diseases.

## **4.2 Vaccines:**

4.2.1 General Introduction to vaccines.

4.2.2 Type of vaccines.

4.2.3 Transplantation Immunology

## **Co- Curricular activities**

Vaccines and herd immunity activities - Ideas for public engagement activities surrounding vaccines and herd immunity. Includes hands-on activities and educational materials.

COVID-19 immunology and vaccines - Variety of activities, infographics, animations, Q&A videos and much more, suitable for all ages.

Origami antibody & virus - Have fun testing your creative skills while finding out more about how antibodies and viruses interact with our immune systems.

Super Cells and Super Cells II - Educational cartoon videos describing the roles of different immune cells and how these cause - and dampen down - inflammation.

The Secret Life of Snot - Snot, what's it all about? Resources on what snot is, why we make it and what it can tell you about your health...plus a recipe to make your own snot at home!

Malaria - A series of resources for College focusing on the science of malaria.

Allergy and Asthma - Our educational resource looking into Asthma. We have a range of ideas for activities surrounding allergy and asthma, and explain what asthma is, the link between allergies and asthma as well as what happens in an asthma attack.

## **References:**

1. The elements of Immunology by Fahim Halim Khan
2. Textbook of Immunology Constantin A. Bona, Francisco A. Bonilla
3. Kuby Immunology by Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis
4. Immunobiology by Janeways
5. Essentials of Clinical Immunology by Helen Chapel, Mansel Haeney, Siraj Misbah & Neil Snowden
6. Cellular and Molecular Immunology by Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai

7. Roitt's Essential Immunology by Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt
8. Janeway's Immunobiology by Kenneth M. Murphy, Casey Weaver
9. Basic and Clinical Immunology by Mark Peakman, Diego Vergani
10. Clinical Immunology: Principles and Practice by Robert R. Rich MD, Thomas A Fleisher MD FAAAAI FACAAI, William T. Shearer MD PhD, Harry Schroeder, Anthony J. Frew MD FRCP, Cornelia M. Weyand MD PhD
11. Allergy and Immunology for the Internist, An Issue of Medical Clinics of North America (Volume 104-1) (The Clinics: Internal Medicine, Volume 104-1) by Anne Marie Ditto MD
12. Manual of Molecular and Clinical Laboratory Immunology (ASM Books) By Barbara Detrick, Robert G. Hamilton, John L. Schmitz
13. Immunology Made Ridiculously Simple by Massoud Mahmoudi
14. How the Immune System Works (The How it Works Series) by Lauren M. Sompayrac
15. Oral Microbiology and Immunology (ASM Books) by Richard J. Lamont, George N. Hajishengallis, Hyun (Michel) Koo, Howard F. Jenkinson
16. Reproductive Immunology: Basic Concepts by Gil Mor MD PhD
17. Review of Medical Microbiology and Immunology by Warren Levinson
18. Cellular and Molecular Immunology by Abul K. Abbas MBBS, Andrew H. Lichtman MD PhD, Shiv Pillai MBBS PhD
19. Fundamental Immunology by William E. Paul
20. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson
21. Practical Immunology A Laboratory Manual; LAP LAMBERT Academic Publishing

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY  
BLUE PRINT**

**III Year B.Sc., Zoology**

**ZOOLOGY SYLLABUS FOR ELECTIVE – VII-A  
VI SEMESTER**

**IMMUNOLOGY  
Under CBCS Pattern**

| <b>Module Name</b> | <b>PART I<br/>Essay Type<br/>Questions<br/>10 marks each</b> | <b>Part II Short<br/>Answer Questions<br/>5 marks each</b> | <b>Marks Allotted to<br/>the Chapter</b>                                            |
|--------------------|--------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Module - I         | <b>2</b>                                                     | <b>02</b>                                                  | <b>30</b>                                                                           |
| Module - II        | <b>1</b>                                                     | <b>03</b>                                                  | <b>25</b>                                                                           |
| Module - III       | <b>1</b>                                                     | <b>03</b>                                                  | <b>25</b>                                                                           |
| Module - IV        | <b>2</b>                                                     | <b>02</b>                                                  | <b>30</b>                                                                           |
| <b>Total</b>       | <b>06<br/>Of which 3 to be<br/>answered</b>                  | <b>10<br/>Of which 6 to be<br/>answered</b>                | <b>110 Marks<br/>including choice.<br/>Of which 60<br/>Marks to be<br/>answered</b> |

**NOTE: The question paper setters are requested to kindly adhere to the format  
given in the above**

## **Question Bank**

### **Essay Questions**

1. Write an essay on basic concepts in Immune System
2. Adaptive immunity
3. What are the cells of immune system
4. Describe the organs of immune system
5. Describe the basic properties of antigens
6. B Cells
7. T Cells
8. Epitopes
9. Haptens
10. Adjuvants
11. Write an essay on classes and functions of antibodies
12. Monoclonal Antibodies
13. Structure and functions of major histocompatibility complexes
14. Describe the various types of hypersensitivities.
15. What is auto immunity
16. What are the various types of auto immune diseases
17. Define Vaccines and describe the various types of vaccines
18. Write notes on Factors influencing the immunogenicity
19. Natural live vaccines

### **Short Answer questions**

1. Explain the cells of immune system
2. Describe the adaptive immunity
3. Write notes on Factors influencing the immunogenicity
4. Explain the B and T cell functions
5. Explain the different types of antibodies
6. Describe the antigen antibody interactions
7. Describe the major histocompatibility complexes
8. Explain the cell mediated immunity
9. Describe the various types of Hypersensitivities
- 10 Explain the concept of autoimmunity

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**SYLLABUS FOR VI SEMESTER: ZOOLOGY  
ELECTIVE VII (A)**

**IMMUNOLOGY**

**TIME: 3 Hrs**

**Max. Marks: 60**

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**Part- -I**

- I. Answer any **three** of the following choosing at least one question from each section .  
Draw a neat labelled diagram where ever necessary

**Section A**

**3 x10 = 30 Marks**

1. Explain the cells of immune system
2. Describe the adaptive immunity
3. Write notes on Factors influencing the immunogenicity

**Section B**

4. Describe the major histocompatibility complexes
5. Describe the various types of Hypersensitivities
6. Explain the concept of autoimmunity

**Part- -II**

Answer any Six of the following

**6 x 5=30M**

7. Adaptive immunity
8. Antigens
9. Monoclonal Antibody
10. Hypersensitivity and Types
11. Natural live vaccines
12. Epitopes
13. Heptane
14. Properties of Antigens
15. Cell mediated immunity
16. MABS

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**Practical Syllabus for**

**VI Semester: ZOOLOGY PAPER-: VII (A)**

**IMMUNOLOGY**

**Periods:30 Hrs.**

**Max.Marks:50**

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1. Demonstration of Lymphoid Organs (as per UGC Guidelines).
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
  - a. ELISA
  - b. Immuno electrophoresis

**P R GOVERNMENT COLLEGE (AUTONOMOUS): KAKINADA**

**DEPARTMENT OF ZOOLOGY**

**Model Paper for VI Semester:**

**ZOOLOGY PAPER: VII (A)**

**IMMUNOLOGY**

*Time:3Hrs.*

*Max.Marks:50*

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**Draw labeled diagrams where ever necessary.**

- |           |                                                 |                  |
|-----------|-------------------------------------------------|------------------|
| <b>1.</b> | <b>Answer the following.</b>                    | <b>2x5=10M</b>   |
|           | (a).                                            |                  |
|           | (b).                                            |                  |
| <b>2.</b> | <b>Answer the following.</b>                    | <b>3x5=15M</b>   |
|           | (a).                                            |                  |
|           | (b).                                            |                  |
|           | (c).                                            |                  |
| <b>3.</b> | <b>Experiment-Blood groups- A, B, AB and O.</b> | <b>1x 10=10M</b> |
| <b>4.</b> | <b>Experiment.....(Demonstration of)</b>        | <b>1x10=10M</b>  |
| <b>5.</b> | <b>Practical Record.</b>                        | <b>1x5=5</b>     |

**P.R.GOVERNMENT COLLEGE (A), KAKINADA CHOICE BASED CREDIT SYSTEM  
ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE –VIII-B: VI SEMESTER**

**AQUACULTURE**

**Cluster Elective Paper: VIII-B-1 PRINCIPLES OF AQUACULTURE**

CREDITS:3T+2P

Hrs : 3 T+ 2 P/week

| OBJECTIVES                                                                                                                                                                                                                                                | LEARNING OUTCOMES                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. The student Inculcates knowledge on basic principles of aquaculture<br><br>2. Understand the types of different aquaculture systems<br><br>3. Develops skill in design and construction of fish farm<br><br>4. Will be able to manage the culture pond | <ul style="list-style-type: none"><li>• Described the fisheries and fishery industries, Understood the various types and Methods of aquaculture practices.</li><li>• Understood the physiology and reproductive mechanisms of important fishes.</li><li>• Understood the modern techniques and methods of fishery industries.</li><li>• Attained knowledge about important cultivable fin fishes, shell fishes and importance of value-added fishery products</li></ul> |

**PRINCIPLES OF AQUACULTURE**

**Module – I**

Introduction / Basics of Aquaculture

1.1 Definition, Significance and History of Aquaculture

1.2 Present status of Aquaculture – Global and National scenario

1.3 Major cultivable species for aquaculture: freshwater, brackish water and marine.

1.4 Criteria for the selection of species for culture

**Module – II**

Types of Aquaculture

2.1 Freshwater, Brackish water and Marine resources

2.2 Concept of Monoculture, Polyculture, Composite culture, Monosex culture and Integrated fish farming

2.3. Culture systems - Ponds, Raceways, Cages, Pens, Raft culture

2.4. Culture practices - Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish and shrimp.

## **Module – III**

- 3.1 Design and construction of aquafarms - Criteria for the selection of site for freshwater pond farms- Design and construction of fish farms
- 3.2 Nutrition and feeds - Nutritional requirements of a cultivable fish and shellfish - Natural food and Artificial feeds and their importance in fish and shrimp culture
- 3.3 Culture of Pearl oysters, culture of seaweeds, culture of ornamental fishes

## **Module – IV**

- 4.1. Management of carp culture ponds - Culture of Indian major carps: Pre-stocking management – Dewatering, drying, ploughing/desilting; Predators, weeds and algal blooms and their control, Liming and fertilization;
  - 4.2. Stocking management – Stocking density and stocking;
  - 4.3 Post-stocking management – Feeding, water quality, growth and health care; and Harvesting of ponds
  - 4.4. Culture of *Penaeus monodon* or *Litopenaeus vannamei*
- Additional inputs
- a. Culture systems raceways
  - b. Blue revolution

**BLUE PRINT**

**III Year B.Sc.,Zoology**

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

**AQUACULTURE**

**Cluster Elective Paper: VIII-B-1**

**PRINCIPLES OF AQUACULTURE At the end of V**

**Semester Under CBCS Pattern**

| <b>Module Name</b>                                | <b>PART I<br/>Essay Type<br/>Questions 10<br/>marks each</b> | <b>Part II Short<br/>Answer<br/>Questions<br/>5 marks each</b> | <b>Marks Allotted to<br/>the Chapter</b>                                                |
|---------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1. Introduction /<br>Basics of<br>Aquaculture     | <b>2</b>                                                     | <b>02</b>                                                      | <b>30</b>                                                                               |
| 2. Types<br>of<br>Aquacult<br>ure                 | <b>1</b>                                                     | <b>03</b>                                                      | <b>25</b>                                                                               |
| 3. Design and<br>constructio<br>n of<br>aquafarms | <b>2</b>                                                     | <b>02</b>                                                      | <b>30</b>                                                                               |
| 4.<br>Management<br>of culture<br>ponds           | <b>1</b>                                                     | <b>03</b>                                                      | <b>25</b>                                                                               |
| <b>Total</b>                                      | <b>06<br/>Of which 3 to be<br/>answered</b>                  | <b>10<br/>Of which 6 to be<br/>answered</b>                    | <b>110 Marks<br/>including<br/>choice.<br/>Of which 60<br/>Marks to be<br/>answered</b> |

**NOTE: The question paper setters are requested to kindly adhere to the format given in the above**

**MODEL QUESTION PAPER**  
**P R GOVERNMENT COLLEGE (AUTONOMOUS),**  
**KAKINADA ZOOLOGY SYLLABUS FOR CLUSTER**  
**ELECTIVE -VIII-B: VI SEMESTER**

**AQUACULTURE**

**Cluster Elective Paper: VIII-B-1 PRINCIPLES OF AQUACULTURE**

**Time: 2½hrs.**

**Max Marks: 60**

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**PART - 1**

**Note : Answer any THREE questions choosing at least one question from each section. Draw the diagrams wherever necessary 3 X10 = 30**

**SECTION- A**

1. What is the current status of aquaculture at global and national level
2. What are the major cultivable species of fresh water fishes
- 3 What are various culture practices of fishes

**SECTION-B**

4. Write an essay on design and construction of fish farm
5. Explain Natural and artificial feeds and their importance in fish culture
6. write an essay on Stocking management of a fishpond

**Part - II**

Answer any **Six** questions

**6x5=30**

7. Food fishes of Marinewaters
8. criteria of Selection of species fishculture
9. Polyculture
10. Penculture
11. Freshwaterresouces
12. Selection of site for fishpond
13. Sea weed culture
14. Algalblooms
15. Ornamentalfishes
16. Liming andFertilization.

### **III Year B.Sc., Zoology**

#### **ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE -VIII- B: VI SEMESTER**

##### **Cluster Elective Paper: VIII- B-1 PRINCIPLES OF AQUACULTURE**

#### **PRACTICAL SYLLABUS**

##### **Cultivable fishes**

1. Identification and study of important cultivable and edible fishes – Any five
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  
Any Five

##### **Pond Management**

1. Water Quality -Determination of temperature, pH, salinity in the pond water sample; Estimation of dissolved oxygen, total alkalinity, total hardness.
2. Soil analysis – Determination of soil texture, pH, conductivity,
3. Identification of common zooplankton, aquatic insects and aquatic weeds – Each 3

**Model paper for Practical semester End Examination**

Max.Marks 50

Time: 2 Hours

1. Estimate the dissolved oxygen/salinity/hardness of a given pond water sample  
10M
2. Identify the followings potters: 15 M  
(5x3) A Freshwater/Marine fish  
B. Fish disease  
C. Aquarium fish  
D. Crustacean  
E Zooplankton/Aquatic weed
3. Record 05M
4. Internal Assessment 15 M

**Total**

**50M**

# Question Bank for Principles of Aquaculture

## Module I

### Essay Questions

1. What is the current status of aquaculture at global and national level?
2. Explain the concept of Blue Revolution
3. Describe Major Cultivable Fresh water fishes
4. What are the characters to be present in cultivable fishes

### Short Answer Questions

1. Any 2 Brackish water food fishes
2. Any 2 Marine food fishes
3. Criteria for selection of Fishes for cultivation
4. Significance of Aquaculture

## Module II

### Essay Questions

1. What are different Freshwater fishery resources of India
2. What are different culture practices of aquaculture
3. What are different brackish water fishery resources of India

### Short Answer Questions

1. Polyculture
2. Cage culture
3. Pen culture
4. Raft culture
5. Mono sex culture
6. Integrated fish farming
7. Mackerel fishery
8. Oil Sardine fishery

## Module III

### Essay Questions

1. Explain Design and Construction of Aquafarm
2. Write an essay on Natural and Artificial feeds
3. Explain in detail the culture of Pearloysters
4. Write notes on Criteria for selection of site for freshwater pond farm

### Short Answer Questions

1. Culture of seaweeds
2. Breeding of ornamental fishes
3. Nursery Pond
4. Live feed

## Module IV

### Essay Questions

1. Describe the culture of *Litopenaeus vannamei*
2. Write an essay on Pre stocking management of fishpond
3. Write an essay on Post stocking management of fish pond

### Short Answer Questions

1. Liming
2. Algal blooms and their control
3. Stocking density
4. *Penaueus monodon*
5. Predators
6. Fertilization
7. White spotdisease
8. Water quality

## REFERENCES BOOKS

1. Bardach, JE *et al.* 1972. *Aquaculture - The farming and husbandry of freshwater and marine organisms*, John Wiley & Sons, NewYork.
2. Bose AN *et al.* 1991. *Coastal aquaculture Engineering*. Oxford & IBHPubl.Co.Pvt.Ltd.
3. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*. DayaPubl.House.
4. FAO. 2007. *Manual on Freshwater Prawn Farming*.
5. Huet J. 1986. *A text Book of Fish Culture*. Fishing News BooksLtd.
6. ICAR. 2006. *Hand Book of Fisheries and Aquaculture*. ICAR.
7. Ivar LO. 2007. *Aquaculture Engineering*. DayaPubl.House.
8. Jhingran V.G. 2007. *Fish and Fisheries of India*. Hindustan Publ. Corporation, India.
9. Landau M. 1992. *Introduction to Aquaculture*. John Wiley & Sons.
10. Lovell RT. 1998. *Nutrition and Feeding of fishes*. Chapman & Hall.
11. Mcvey JP. 1983. *Handbook of Mariculture*. CRC Press.
12. MPEDA: *Handbooks on culture of carp, shrimp, etc.*
13. New MB. 2000. *Freshwater Prawn Farming*. CRC Publ.
14. Pillay TVR. 1990. *Aquaculture- Principles and Practices*, Fishing News Books Ltd., London.
15. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. 2nd Ed. Blackwell
16. Rath RK. 2000. *Freshwater Aquaculture*. Scientific Publ.
14. Stickney RR. 1979. *Principles of Warmwater Fish Culture*, John Wiley & Sons
15. Wheaton FW. 1977. *Aquacultural Engineering*. John Wiley & Sons.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**CHOICE BASED CREDIT SYSTEM**  
**ZOOLOGY SYLLABUS**  
**P.R.GOVERNMENT COLLEGE (A), KAKINADA**  
**CHOICE BASED CREDIT SYSTEM**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-B-2**  
**VI SEMESTER**

**AQUACULTURE MANAGEMENT**

CREDITS: 3T+2P

Hrs : 3 T+ 3 P /week

| OBJECTIVES                                                                                                                                                                                                                           | LEARNING OUTCOMES                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Understands the Hatchery management techniques</p> <p>Comprehends Water quality parameters</p> <p>Be aware of the feed management and quality assurance</p> <p>Familiar with disease diagnostics and treatment in aquaculture</p> | <ul style="list-style-type: none"> <li>• Understands the Breeding techniques, Induced breeding, Hatchery management in fishes and Shrimps</li> <li>• Develops Skill in testing the water quality suitable for fish culture, different aeration methods and emergency aeration</li> <li>• Attains knowledge of fish feeds, live feeds, feed formulation, feed additives</li> <li>• Be familiar with the various diseases and their control in fishes, various straining</li> </ul> |

**Module – I**

**Breeding and Hatchery Management**

- 1.1. Induced breeding of carp by Hypophysation; and use of synthetic hormones
- 1.2. Hatchery management of Indian major carps
- 1.3 Breeding and Hatchery management of *Penaeus monodon* / *Litopenaeus vannamei*

**Module – II**

**Water quality Management**

- 2.1 Water quality and soil characteristics suitable for fish and shrimp culture
- 2.2 Identification of oxygen depletion problems and its control in culture ponds
- 2.3 Aeration: Principles of aeration and Emergency aeration
- 2.4 Liming materials, Organic manures and Inorganic fertilizers commonly used and their implications in fish ponds

**Module – III**

**Feed Management**

- 3.1 Live Foods and their role in shrimp larval nutrition.
- 3.2 Supplementary feeds; Types of feeds; Feed additives and Preservatives; role of probiotics.
- 3.3 Feed formulation and manufacturing; feed conversion efficiencies and ratios

**Module – IV**

- 4.1 Principles of disease diagnosis and health management; Fish immunization and vaccination

4.2 Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish and shrimp diseases

4.3 Fisheries Training and Education in India; Role of extension in community

4.4 Gynogenesis, Androgenesis, Polyploidy, Transgenic fish, Cryopreservation of gametes,

Production of monosex and sterile fishes and their significance in aquaculture.

## **BLUE PRINT**

**III Year B.Sc., Zoology**

**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-B-2  
VI SEMESTER**

**AQUACULTURE MANAGEMENT**  
**Under CBCS Pattern**

| <b>Module Name</b>                  | <b>PART I<br/>Essay Type<br/>Questions<br/>10 marks each</b> | <b>Part II Short<br/>Answer Questions<br/>5 marks each</b> | <b>Marks Allotted to<br/>the Chapter</b>                                |
|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------|
| 1. Breeding and Hatchery Management | 2                                                            | 02                                                         | 30                                                                      |
| 2. Water quality Management         | 1                                                            | 03                                                         | 25                                                                      |
| 3. Feed Management                  | 1                                                            | 03                                                         | 25                                                                      |
| 4. Diseases, training and genetics  | 2                                                            | 02                                                         | 30                                                                      |
| <b>Total</b>                        | <b>06<br/>Of which 3 to be answered</b>                      | <b>10<br/>Of which 6 to be answered</b>                    | <b>110 Marks including choice.<br/>Of which 60 Marks to be answered</b> |

**NOTE:** The question paper setters are requested to kindly adhere to the format given in the above

**MODEL QUESTION PAPER**

**P R GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**III Year B.Sc., Zoology**

**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-B-2**  
**VI SEMESTER**

**AQUACULTURE MANAGEMENT  
MODEL PAPER**

**Time: 2 ½ hrs.**

**Max Marks: 60**

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**PART – 1**

**Note :Answer any THREE questions choosing at least one question from each section. Draw the diagrams where ever necessary**

**3 X10 = 30**

**SECTION- A**

1. Describe Induced breeding in carps
2. Give detailed account of Hatchery Management of *Litopenaeus vannamei*
- 3 Describe water quality Management for fish culture

**SECTION-B**

4. Write an essay on Feed formulation and Manufacturing
5. Describe symptoms, Prophylaxis and therapy of any 4 fish diseases
6. Explain fishery training and Education in India

**Part – II**

Answer any **Six** questions

**6x5=30**

7. Types of Hatcheries
8. Larval Stages of Prawn
9. Liming materials
10. Organic Manures
11. Principles of aeration
12. Live feed
13. Role of Probiotics
- 14 Feed Additives
15. Gynogenesis and Androgenesis
16. Fish Vaccination.

**III Year B.Sc., Zoology**

**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-B-2  
VI SEMESTER**

**AQUACULTURE MANAGEMENT  
PRACTICAL SYLLABUS**

**Nutrition**

1. Identification and study of Live food organisms – Any five
2. Formulation and preparation of a balanced fish feed ( procedure)
3. Gut content analysis to identify the food intake.
4. Proximate estimation of aquaculture feeds for protein, carbohydrates, moisture, ash content

### **Post harvest Technology**

1. Identification and evaluation of fish/ fishery products
2. Preparation of Isinglass, Collagen and Chitosan (procedure)
4. Developing flow charts and exercises in identification of hazards in processing of fish.

### **Model paper for Practical semester End Examination**

Max. Marks 50

Time: 2 Hours

1. Analyse the gut contents of a given fish/Estimate the Protein/carbohydrate/ash content of the given fish feed

10M

2. Identify the following spotters:

15 M (5x3)

A Live feed

B. Live feed

C. Fish feed type

D Fish byproduct

E Fish byproduct

3. Record

05 M

4. Internal Assessment

15 M

**Total**

**50M**

### **Question Bank for Aquaculture Management**

#### **Module I**

#### **Essay Questions**

1. Describe Induced breeding in carps
2. Give detailed account of Hatchery Management of *Litopenaeus vannamei*
3. Give detailed account of Hatchery Management of Indian Major carps

4. Describe Hypophysiation and use of synthetic hormones in fishes

#### Short Answer Questions

1. Types of Hatcheries
2. Larval Stages of Prawn
3. Advantages of Induced breeding
4. Ovaprim

### Module II

#### Essay Questions

1. Describe water quality Management for fish culture
2. Write an essay on identification of oxygen depletion problems and its control
3. What are principles of aeration and emergency aeration
4. Describe water quality and soil characteristics suitable for fish culture

#### Short Answer Questions

1. Liming materials
2. Organic Manures
3. Reasons for Oxygen depletion
4. Water quality for fish culture
5. Soil characters required for fish culture
6. Emergency control of oxygen depletion

### Module III

#### Essay Questions

1. Write an essay on Feed formulation and Manufacturing
2. Explain Live foods and their role in shrimp larval rearing
3. Describe different types of feeds
4. Explain supplementary feeding

#### Short Answer Questions

1. Types of feeds
2. Feed additives and preservatives
3. Probiotics and their significance
4. Feed Conversion Ratio
5. Feed formulations

### Module IV

#### Essay Questions

1. Describe symptoms, Prophylaxis and therapy of any 4 fish diseases
2. Explain fishery training and Education in India
3. Describe symptoms, Prophylaxis and therapy of any 4 shrimp diseases
4. Write an essay on production of monosex and sterile fishes and their significance
5. Describe genetic improvement of fish stocks

#### Short Answer Questions

1. Gynogenesis
2. Androgenesis
3. Transgenic fish
4. Any two viral diseases in prawns
5. Any two bacterial diseases in fish
6. Fish vaccination
7. Any two fungal diseases of fish
8. SIFT
9. CIFE
10. NIFPHATT

### REFERENCE BOOKS

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## POSTHARVEST TECHNOLOGY

CREDITS:3T+2P

Hrs : 3 T+ 3 P/week

| OBJECTIVES                                                                                                                                                                                                                                    | LEARNING OUTCOMES                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aquires knowledge on the fish preservation<br><br>Be familiar with the principles of fish preservation and spoilage<br><br>Aquires knowledge on fish byproducts<br><br>Learns various sanitation and quality control in fish processing units | 1.Learns to handle fish during transport. Understands the post-mortem changes<br><br>2.Understands the principle behind the preservation of fishes like icing, salting, freezing<br><br>3.Attains knowledge on processing and preservation and fish byproducts and quality control during marketing<br><br>4.Be familiar with various hygiene precautions during processing of aquatic products. Understand the importance of seaweed culture |

### Syllabus

#### Module – I

##### Handling and Principles of fish Preservation

- 1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in fishes.
- 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.

#### Module II

##### Methods of fish Preservation

- 2.1. Traditional methods - sun drying, salt curing, pickling and smoking.
- 2.2 Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, Irradiation and Accelerated Freeze drying (AFD).

#### Module -III

##### Processing and preservation of fish and fish by-products and quality control

- 3.1 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.

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

3.3. 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

## **Module – IV**

### **Sanitation and Quality control**

- 41 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.
- 42 Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.
- 43 **Seaweed Products:** Use of seaweeds as food for human consumption, preparation of therapeutic drugs.

### **Additional inputs**

- 1. National and International standards – ISO 9000: 2000 Series of Quality Assurance System

**BLUE PRINT**

**P.R. GOVERNMENT COLLEGE (A),  
KAKINADA CHOICE BASED CREDIT  
SYSTEM**

**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-  
B-3 VI SEMESTER**

**POSTHARVEST TECHNOLOGY**

| <b>Module Name</b>                                                             | <b>PART I<br/>Essay Type<br/>Questions 10<br/>marks each</b> | <b>Part II Short<br/>Answer<br/>Questions<br/>5 marks each</b> | <b>Marks Allotted to<br/>the Chapter</b>                                                |
|--------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1. Handling and Principles of fish Preservation                                | <b>1</b>                                                     | <b>03</b>                                                      | <b>25</b>                                                                               |
| 2. Methods of fish Preservation                                                | <b>2</b>                                                     | <b>02</b>                                                      | <b>30</b>                                                                               |
| 3 Processing and preservation of fish and fish by-products and quality control | <b>2</b>                                                     | <b>02</b>                                                      | <b>30</b>                                                                               |
| 4. Sanitation and Qualitycontrol                                               | <b>1</b>                                                     | <b>03</b>                                                      | <b>25</b>                                                                               |
| <b>Total</b>                                                                   | <b>06<br/>Of which 3 to be<br/>answered</b>                  | <b>10<br/>Of which 6 to be<br/>answered</b>                    | <b>110 Marks<br/>including<br/>choice.<br/>Of which 60<br/>Marks to be<br/>answered</b> |

**NOTE: The question paper setters are requested to kindly adhere to the format given in the above**

**P.R. GOVERNMENT COLLEGE (A),  
KAKINADA CHOICE BASED CREDIT  
SYSTEM**

**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-  
B-3 VI SEMESTER**

**POSTHARVEST TECHNOLOGY MODEL QUESTION PAPER**

**Time: 2½hrs.**

**Max Marks: 60**

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**PART – 1**

**Note :Answer any THREE questions choosing at least one question from each section. Draw the diagrams wherever necessary** **3 X10 = 30**

**SECTION- A**

1. Describe various aspects of storage and transport of fishes
2. What are different traditional methods of fish preservation
3. 3 Explain Chilling, Freezing and Accelerated Freeze drying

**SECTION-B**

4. Write an essay on various fish by-products
5. Write an essay on Seafood Quality Assurance and Systems.
6. Explain various environmental hygiene and personal hygiene in processing plants

**Part – II**

Answer any **Six** questions

**6x5=30**

7. Handling of fresh fish
8. Post Mortem Changes
9. Reasons for spoilage of fishes
10. Canning
11. Smoking offish
12. Fish Oils

13. Good Laboratory Practices

14. Seaweeds

15. Pre processing control of quality

16. Sanitation.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA CHOICE BASED CREDIT SYSTEM  
ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE – VIII-  
B-3 VI SEMESTER**

**POSTHARVEST TECHNOLOGY MODEL QUESTION PAPER**

**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

# **Question Bank for POSTHARVEST TECHNOLOGY**

## **Module I**

### **Essay Questions**

1. Describe various aspects of storage and transport of fishes
2. What are various principles of storage
3. Write an essay on fish spoilage

### **Short Answer Questions**

4. How to identify a fresh fish
5. Need for preservation of fish
6. Handling of fresh fish
7. Post Mortem Changes
8. Reasons for spoilage of fishes
9. Disadvantages of fish preservation

## **Module II**

### **Essay Questions**

10. What are different traditional methods of fish preservation
11. Explain Chilling, Freezing and Accelerated Freeze drying
12. What are different modern methods of fish preservation

### **Short Answer Questions**

13. Canning
14. Smoking of fish
15. Deep Freezing
16. Drying
17. Salting
18. Canning

## **Module III**

### **Essay Questions**

9. Write an essay on various fish by-products
10. Write an essay on Seafood Quality Assurance and Systems
11. Describe fish products – Fish minced meat, fish meal, fish oil, fish liquid, fish protein concentrate briefly
12. What are good manufacturing Practices GMPs

### **Short Answer Questions**

10. Fish Ensilage
11. Isinglass
12. Sharkfins
13. Fishglue
14. HACCP

## **Module IV**

### **Essay Questions**

15. Explain various environmental hygiene and personal hygiene in processing plants
16. Describe use of seaweeds as food for human consumption and preparation of drugs
17. Write an essay on quality control of fish and fishery products

### **Short Answer Questions**

19. Pre processing quality control
20. Post processing quality control
21. Seaweeds
22. Drugs from seaweeds

23. Sanitation in processing plants

24. Personal hygiene in processing plants

**ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM**  
**QUESTION PAPER PATTERN FOR ALL SEMESTER W.E. FROM 2015-16 ADMITTED**  
**BATCH**

**(For all Papers except Foundation Course papers)**

**Time : 3 Hours**

**Maximum Marks: 75**

**Section - A**

**I. Answer any five questions**

**(5x5=25)**

1. Unit- I
2. Unit- II
3. Unit-III
4. Unit- IV
5. Unit-V
6. }
7. }
8. }

|                                                                        |
|------------------------------------------------------------------------|
| <p>Each one from any<br/>of the three units<br/>out of five units.</p> |
|------------------------------------------------------------------------|

**Section- B**

**II. Answer All the Questions**

**(5x10=50)**

1. (a) or (b) from Unit -I
2. (a) or (b) from Unit -II
3. (a) or (b) from Unit -III
4. (a) or (b) from Unit -IV
5. (a) or (b) from Unit -V