



**Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE**

**(AUTONOMOUS)**

**NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH**

**Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.**

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**DEPARTMENT OF ZOOLOGY**

**PROPOSED SYLLABUS FOR**

**ZOOLOGY**

**IN THE UNDERGRADUATE DEGREE PROGRAMME**

**UNDER AUTONOMY**

**2019-2020**

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM**  
**ZOOLOGY PAPER STRUCTURE UNDER CBCS (w.e.f. 2019-20)**

| YEAR   | SEMESTER                              | PAPER   | TITLE  | MAR KS | CREDITS |    |
|--|---------------------------------------|---|--|--------|---------|----|
| <b>I</b>                                       | <b>I</b>                              | <b>I</b>  | Biology of Non-chordates                               | 100    | 03      |    |
|  |                                       |   | Practical - I  | 50     | 02      |    |
|  | <b>II</b>                             | <b>II</b>   | Biology of Chordates                                   | 100    | 03      |    |
|  |                                       |   | Practical - II   | 50     | 02      |    |
| <b>II</b>                                      | <b>III</b>                            | <b>III</b>  | Cell biology, Genetics and Evolution                   | 100    | 03      |    |
|  |                                       |   | Practical - III  | 50     | 02      |    |
|  | <b>IV</b>                             | <b>IV</b>   | Embryology, Physiology and Ecology                     | 100    | 03      |    |
|  |                                       |   | Practical - IV   | 50     | 02      |    |
| <b>III</b>                                     | <b>V</b>                              | <b>V</b>  | Animal Biotechnology                                   | 100    | 03      |    |
|  |                                       |   | Practical - V  | 50     | 02      |    |
|  |                                       | <b>VI</b>   | Animal Husbandry                                       | 100    | 03      |    |
|  |                                       |   | Practical - VI   | 50     | 02      |    |
|  | *Any one Paper from A, B and C        | <b>VII (A)*</b>   | Immunology   | 100    | 03      |    |
|  |                                       |   | Practical - VII (A)                                    | 50     | 02      |    |
|  |                                       | <b>VII (B)*</b>   | Cellular Metabolism and Molecular Biology              | 100    | 03      |    |
|  |                                       |   | Practical - VII (B)                                    | 50     | 02      |    |
|  |                                       | <b>VII (C)*</b>   | Bioinformatics   | 100    | 03      |    |
|  |                                       |   | Practical - VII (C)                                    | 50     | 02      |    |
|  | ** Any one cluster from I, II and III | <b>Cluster VIII-A**</b>   | <b>Cluster Electives –VIII-A : Medical Diagnostics</b> |        | 100     | 03 |
|  |                                       |   | 1. Clinical Biochemistry                               | 100    | 03      |    |
|  |                                       |   | 2. Haematology   | 100    | 03      |    |
|  |                                       |   | 3. Clinical Microbiology                               | 50     | 02      |    |
|  |                                       |   | Practical – VIII: 1                                    | 50     | 02      |    |
|  |                                       |   | Practical – VIII: 2                                    | 50     | 02      |    |
| Project Work                                   |                                       |   |  |        |         |    |
| <b>Cluster Electives –VIII-B : Aquaculture</b> |                                       |   | 100  | 03     |         |    |
| 1. Principles of Aquaculture                   |                                       |   | 100  | 03     |         |    |
| 2. Aquaculture Management                      |                                       |   | 100  | 03     |         |    |
| 3. Postharvest Technology                      | 100                                   | 03  |  |        |         |    |
| Practical – VIII: 1                            | 50                                    | 02  |  |        |         |    |
| Practical – VIII: 2                            | 50                                    | 02  |  |        |         |    |
| Project Work                                   | 50                                    | 02  |  |        |         |    |
| <b>VI</b>                                      | <b>Cluster VIII-C**</b>               | <b>Cluster Electives – VIII-C : Sericulture</b>                 |  |        |         |    |
|  |                                       | 1. Gen. Sericulture, Mulberry cultivation and Management        | 100  | 03     |         |    |
|  |                                       | 2. Biology of Mulberry Silkworm and Silkworm rearing Technology | 100  | 03     |         |    |
|  |                                       | 3. Silk Technology, Silk Marketing and Extension                | 100  | 03     |         |    |
|  |                                       | Practical – VIII: 1   | 50   | 02     |         |    |
|  |                                       | Practical – VIII: 2   | 50   | 02     |         |    |
|  |                                       | Project Work  | 50   | 02     |         |    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
(w.e.f. 2019-20)

**ZOOLOGY SYLLABUS FOR I SEMESTER**  
**ZOOLOGY - PAPER - I**

**ANIMAL DIVERSITY – BIOLOGY OF NON-CHORDATES**

**Periods: 60**

**Max. Marks: 100**

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**Unit - I**

- 1.1 Brief history, Significance of Diversity of Non Chordates
- 1.2 Protozoa
  - 1.2.1 General characters
  - 1.2.2 Classification of Protozoa up to classes with examples
  - 1.2.3 *Elphidium* (type study)
- 1.3 Porifera
  - 1.3.1 General characters
  - 1.3.2 Classification of Porifera up to classes with examples
  - 1.3.3 *Sycon* – External Characters, Types of cells,
  - 1.3.4 Skelton in Sponges
  - 1.3.5 Canal system in sponges

**Unit - II**

- 2.1 Coelenterata
  - 2.1.1 General characters
  - 2.1.2 Classification of Coelenterata up to classes with examples
  - 2.1.3 *Obelia* - External Characters, Structure of Polyp and Medusa
  - 2.1.4 Polymorphism in coelenterates
  - 2.1.5 Corals and coral reef formation
- 2.2 Platyhelminthes
  - 2.2.1 General characters
  - 2.2.2 Classification of Platyhelminthes upto classes with examples
  - 2.2.3 *Fasciola hepatica* - External Characters, Excretory system, Reproductive System,  
Life History and pathogenicity

**Unit - III**

- 3.1 Nematelminthes
  - 3.1.1 General characters
  - 3.1.2 Classification of Nematelminthes up to classes with examples
- 3.2 Annelida
  - 3.2.1 General characters
  - 3.2.2 Classification of Annelida up to classes with examples
  - 3.2.3 *Hirudinaria granulosa* - External Characters, Digestive System, Excretory System  
and Reproductive System
  - 3.2.4 Coelomoducts
  - 3.2.5 Vermiculture - Scope, significance, earthworm species, processing,  
Vermicompost, economic importance of vermicompost

**Unit - IV**

- 4.1 Arthropoda
  - 4.1.1 General characters
  - 4.1.2 Classification of Arthropoda up to classes with examples
  - 4.1.3 Prawn - External Characters, Appendages, Respiratory system and Circulatory System
  - 4.1.4 *Peripatus* - Structure and affinities
- 4.2 Mollusca
  - 4.2.1 General characters
  - 4.2.2 Classification of Mollusca up to classes with examples
  - 4.2.3 Pearl formation in Pelecypoda
  - 4.2.4 Torsion in gastropods

### **Unit - V**

- 5.1 Echinodermata
  - 5.1.1 General characters
  - 5.1.2 Classification of Echinodermata up to classes with examples
  - 5.1.3 Water vascular system in star fish
- 5.2 Hemichordata
  - 5.2.1 General characters
  - 5.2.2 Classification of Hemichordata up to classes with examples
  - 5.2.3 *Balanoglossus* - Structure and affinities
- 5.3 Non-Chordata larval forms
  - 5.3.1 Amphiblastula
  - 5.3.2 Ephyra
  - 5.3.3 Trochophore
  - 5.3.4 Nauplius
  - 5.3.5 Glochidium
  - 5.3.6 Bipinnaria
  - 5.3.7 Tornaria

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A),**

**VISAKHAPATNAM**

**ZOOLOGY SYLLABUS (W.E.F. 2019 – 2020)**

**SEMESTER-I**

**PAPER- I**

**Hrs/Week: 4**

**ANIMAL DIVERSITY – NON CHORDATES**

**MODEL PAPER**

**Time : 3 hrs**

**Max. Marks :**

**60**

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**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Define Alternation of generations and explain with reference to the life cycle of *Elphidium*.  
OR  
b. Write an essay on canal system in sponges.
2. a. Give an account of the polymorphism in Coelenterates.  
OR  
b. Discuss briefly the life cycle and pathogenicity of *Fasciola hepatica*.
3. a. Write an essay on digestive system in leech.  
OR  
b. Describe the scope, significance, processing and economic importance of vermiculture.
4. a. Give in account of the Structure and affinities of *Peripatus*.  
OR  
b. Describe in detail the process of pearl formation in Pelecypoda and add a note on its economic importance.
5. a. Write the structure and functions of water vascular system in star fish.  
OR  
b. Give an account of the structure and affinities of *Balanoglossus*.

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Sarcomastigophora
7. Corals
8. Trematoda
9. Polychaeta
10. Cephalic appendages
11. Mollusca General Characters (Any 10)
12. Structure of *Balanoglossus*
13. Any 2 Invertebrate larvae

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**ZOOLOGY SYLLABUS (W.E.F. 2019 – 2020)**

**SEMESTER-I**

**PAPER- I**

**Hrs/Week: 3**

**ANIMAL DIVERSITY – NON CHORDATES (PRACTICAL SYLLABUS)**

**Periods: 24**

**Max. Marks: 50**

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

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

**Demonstration of dissection / dissected / virtual dissection :**

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

**Live Zoology Project & Report:** Visit to a Museum or Zoo or Biodiversity park or Natural water body and submission of a report on

- i. Faunal diversity or
- ii. Ecosystem diversity or
- iii. Plankton Collection and identification or
- iv. Collection of dead specimens (like molluscan shells) and their identification

Note: 1. **Laboratory record work shall be submitted at the time of practical examination**

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

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

## SEMESTER – I :: Course Outcomes

### Animal Diversity I - Biology of Non-chordates

CO1: Understand different levels of biological diversity through the systematic classification of invertebrate fauna

CO2: Familiarize the student with the distinguishing characters of various phyla of Non-chordates by type studies and the study of specialized systems like canal system, water vascular system, torsion etc.

CO3: Understand the evolutionary relationships of different Invertebrate phyla with the study of connecting links like *Peripatus*, *Balanoglossus* and larval forms

CO4: Knowledge on the economic importance of sponges, corals, coral reefs, pearl oysters etc.

CO5: Application of knowledge for the preservation of animals and taxa – level identification of invertebrates

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>  | <b>Knowledge level (Bloom's Taxonomy)</b>                             | <b>Average level weightage</b> |
|--|---|--------------------------------|
| <b>CO1: Understand different levels of biological diversity through the systematic classification of invertebrate fauna</b>  | Level 1 (Knowledge)<br>Level 2 (Understanding)                        | <b>1.5</b>                     |
| <b>CO2: Familiarize the student with the distinguishing characters of various phyla of Non-chordates by type studies and the study of specialized systems like canal system, water vascular system, torsion etc.</b> | Level 1 (Knowledge )<br>Level 3 (Application)                         | <b>2</b>                       |
| <b>CO3: Understand the evolutionary relationships of different Invertebrate phyla with the study of connecting links like <i>Peripatus</i>, <i>Balanoglossus</i> and larval forms</b>                                | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 4 (Analysing) | <b>2.7</b>                     |
| <b>CO4: Knowledge on the economic importance of sponges, corals, coral reefs, pearl oysters etc.</b>   | Level 3 (Application)<br>Level 5 (Evaluation)                         | <b>4</b>                       |

**CO5: Application of knowledge for the preservation of animals and taxa – level identification of invertebrates**

Level 1 (Understanding)

Level 3 (Applying)

Level 4 (Analysing)

Level 5 (Evaluation)

**3.25**

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2   | -   | -   | -   | 1   | 2   | 2   | 2   | 3   |
| CO2 | 2   | 1   | -   | -   | 2   | 3   | 1   | -   | 3   |
| CO3 | 3   | 1   | -   | -   | 2   | 2   | 1   | -   | 3   |
| CO4 | -   | 1   | -   | -   | 3   | 3   | 3   | 3   | 3   |
| CO5 | 2   | -   | -   | -   | 3   | 2   | 2   | 2   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 1    | 2    | 3    | 1    | -    | 3    | -    |
| CO2 | 1    | 2    | 3    | 2    | -    | 3    | 1    |
| CO3 | 1    | 2    | 3    | 3    | -    | 3    | -    |
| CO4 | 3    | 3    | 3    | 3    | -    | 3    | 3    |
| CO5 | 1    | 3    | 3    | 3    | -    | 2    | 2    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**

(w.e.f. 2019-20)

**ZOOLOGY SYLLABUS FOR II SEMESTER**

**ZOOLOGY - PAPER – II**

**ANIMAL DIVERSITY II – BIOLOGY OF CHORDATES**

**Periods:60**

**Max. Marks: 100**

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**Unit - I**

**1.1 General characters of Chordata**

**1.2 Protochordata**

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

**Unit - II**

**2.1 Cyclostomata**

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

**2.2 Pisces**

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

**Unit - III**

**3.1 Amphibia**

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

Heart,

Brain

**3.2 Reptilia**

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

**Unit - IV**

## **4.1 Aves**

4.1.1 General characters of Aves

4.1.2 Classification of Aves upto subclasses with examples.

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

4.1.4 Migration in Birds

4.1.5 Flight adaptation in birds

## **Unit - V**

## **5.1 Mammalia**

5.1.1 General characters of Mammalia

5.1.2 Classification of Mammalia upto sub - classes with examples

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

## **5.3 Dentition in mammals**



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**VISAKHAPATNAM**

**ZOOLOGY SYLLABUS (W.E.F. 2019-'18)**

**SEMESTER-II**

**PAPER - II**

**Hrs/Week : 4**

**ANIMAL DIVERSITY – CHORDATES**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

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**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Explain the origin and general characters of chordates

OR

b. Explain the life history of *Herdmania*

2. a. Compare the characters of *Petromyzon* and *Myxine*

OR

b. Describe the structure of heart of *Scoliodon*

3. a. Describe the brain of *Rana hexadactyla*

OR

b. Explain the external features of *Calotes*

4. a. Write an essay on flight adaptations in birds

OR

b. Explain the respiratory system of *Columba livia*

5. a. Compare the characters of Metatheria and Eutheria

OR

b. Write an essay on dentition in mammals

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Structure of *Amphioxus*

7. Urochordata – General characters (Any 8)

8. General characters of Cyclostomata (Any 8)

9. Placoid scale

10. Apoda

11. Identification of poisonous snakes

12. Ratitae

13. Prototheria

□ □ □ □ □

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A),  
VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019-'18)**

**SEMESTER-II**

**PAPER - II**

**Hrs/Week : 3**

**ANIMAL DIVERSITY – CHORDATES (PRACTICAL SYLLABUS)**

**Periods: 24**

**Max. Marks: 50**

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

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

**Demonstration of dissection / dissected / virtual dissection:**

1. V, VII cranial nerves of shark / locally available fishes
2. Arterial system, venous system of Shark / Calotes / Fowl / Rat
3. Digestive system of fish
4. Prodissector frog / Biolab Frog / Digi frog – Digital Alternative to dissections

Note: 1. **Laboratory record work shall be submitted at the time of practical examination**

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

## SEMESTER – 2 :: Course Outcomes

### ANIMAL DIVERSITY II – BIOLOGY OF CHORDATES

- CO1: Acquire in - depth knowledge on the diversity of chordates and their systematic position.
- CO2: Understand the characteristics and evolutionary importance of Prochordates
- CO3: Understanding the external features, internal anatomy and physiology of various classes of chordates by type studies
- CO4: Study and analyze the specialized features of various chordates such as types of scales and migration in fishes, identification of snakes, flight adaptations and migration in birds, Dentition in mammals etc.
- CO5: Taxonomic identification of chordates by observing preserved and taxidermic specimens of chordates

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>  | <b>Knowledge level (Bloom's Taxonomy)</b>                               | <b>Average level weightage</b> |
|--|---|--------------------------------|
| CO1: Acquire in - depth knowledge on the diversity of chordates and their systematic position.   | Level 1 (Knowledge)<br>Level 2 (Understanding)                          | <b>1.5</b>                     |
| CO2: Understand the characteristics and evolutionary importance of Prochordates  | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 4 (Analyzing)   | <b>3.5</b>                     |
| CO3: Understanding the external features, internal anatomy and physiology of various classes of chordates by type studies  | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2</b>                       |
| CO4: Study and analyze the specialized features of various chordates such as types of scales and migration in fishes, identification of snakes, flight adaptations and migration in birds, Dentition in mammals etc. | Level 3 (Understanding)<br>Level 4 (Analyzing)                          | <b>3.5</b>                     |

|   |                         |     |
|---|-------------------------|-----|
| CO5: Taxonomic identification of chordates by observing preserved and taxidermic specimens of chordates | Level 2 (Understanding) | 3.3 |
|   | Level 3 (Applying)      |     |
|   | Level 5 (Evaluation)    |     |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2   | -   | -   | -   | 1   | 2   | 2   | 2   | 3   |
| CO2 | 3   | 1   | -   | -   | 2   | 2   | 1   | -   | 3   |
| CO3 | 2   | 1   | -   | -   | 2   | 3   | 1   | -   | 3   |
| CO4 | 3   | 3   | -   | 2   | 3   | 1   | 1   | 1   | 3   |
| CO5 | 2   | -   | -   | -   | 3   | 2   | 2   | 2   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 1    | 2    | 3    | 1    | -    | 3    | -    |
| CO2 | 1    | 2    | 3    | 3    | -    | 3    | -    |
| CO3 | 1    | 2    | 3    | 2    | -    | 3    | 1    |
| CO4 | 3    | 3    | 3    | 2    | -    | 2    | 1    |
| CO5 | 1    | 3    | 3    | 3    | -    | 2    | 2    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**

(w.e.f. 2019-20)

**ZOOLOGY SYLLABUS FOR III SEMESTER**

**ZOOLOGY - PAPER - III**

**CYTOLOGY, GENETICS AND EVOLUTION**

**Periods:60**

**Max. Marks:100**

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**Unit - I**

**1. Cytology - I**

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

**Unit – II**

**2. Cell organelles**

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

**Unit - III**

**3. Genetics - I**

- 3.1 Mendel's work on transmission on traits
- 3.2 Principles of inheritance
- 3.3 Incomplete dominance and codominance
- 3.4 Lethal alleles, Epistasis, Pleiotropy

**Unit - IV**

**4. Genetics - II**

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

**Unit - V**

**5. Evolution**

- 5.1 Origin of life
- 5.2 Lamarckism, Darwinism, Neo – Darwinism, Hardy-Weinberg Equilibrium.
- 5.3 Variations, isolating mechanisms, natural selection
- 5.4 Types of natural selection (directional, stabilizing, disruptive)
- 5.5 Artificial selection and forces of evolution
- 5.6 Speciation (Allopatric and Sympatric)
- 5.7 Macro evolutionary principles (Example: Darwin's finches)







## SEMESTER-3

### Paper-III : Cytology, Genetics and Evolution

- CO1: Understand the importance of cell as a structural and functional unit of life, differences between prokaryotic and eukaryotic cells and Viruses as connecting links between life and non-life
- CO2: Thorough understanding of the structure and functions of various cell organelles and the role of nucleus and chromosomes in heredity
- CO3: Understanding the origin and evolution of the concept of heredity & variations by Mendelian experiments and Non-Mendelian principles of gene interactions
- CO4: Study and analyze the importance of linkage and crossing over in bringing about variations and the role of cytoplasm and sex in inheritance.
- CO5: Understand and acquire knowledge on the origin of life and critical evaluation of various theories of evolution, forces of evolution and Origin of new species

| Learning Outcomes: On Completion of the course, the students will be able to   | Knowledge level (Bloom's Taxonomy)                                       | Average level weightage |
|--|--|-------------------------|
| CO1: Understand the importance of cell as a structural and functional unit of life, differences between prokaryotic and eukaryotic cells and Viruses as connecting links between life and non-life | Level 1 (Knowledge )<br>Level 2 (Understanding)                          | 1.5                     |
| CO2: Thorough understanding of the structure and functions of various cell organelles and the role of nucleus and chromosomes in heredity  | Level 1 (Knowledge )<br>Level 2 (Understanding)                          | 1.5                     |
| CO3: Understanding the origin and evolution of the concept of heredity & variations by Mendelian experiments and Non-Mendelian principles of gene interactions                                     | Level 1 (Knowledge),<br>Level 2 (Understanding)<br>Level 3 (Application) | 2                       |
| CO4: Study and analyze the importance of linkage and crossing over in bringing about variations and the role of cytoplasm and sex in inheritance   | Level 3 (Application),<br>Level 4 (Analysing)                            | 3.5                     |

|   |  |     |
|---|--|-----|
| CO5: Understand and acquire knowledge on the origin of life and critical evaluation of various theories of evolution, forces of evolution and Origin of new species | Level 2 (Understanding)<br>Level 4 (Analysing)<br>Level 5 (Evaluation) | 3.7 |
|---|--|-----|

**CO-PO Mapping**  
1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 3   | -   | -   | 1   | 1   | 2   | -   | 3   |
| CO2 | 3   | 3   | -   | -   | 1   | -   | 2   | -   | 3   |
| CO3 | 3   | 3   | 2   | 1   | 2   | 1   | 2   | 2   | 3   |
| CO4 | 3   | 3   | 2   | 1   | 3   | 1   | 3   | 1   | 3   |
| CO5 | 3   | 3   | 2   | 1   | 3   | 3   | 3   | 1   | 3   |

**CO-PSO Mapping**  
1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO7 |
|-----|------|------|------|------|------|------|-----|
| CO1 | 3    | 3    | 3    | 1    | -    | 3    | 1   |
| CO2 | 3    | 3    | 3    | 1    | 1    | 3    | 1   |
| CO3 | 3    | 3    | 3    | 1    | 1    | 3    | 1   |
| CO4 | 3    | 3    | 3    | 1    | 1    | 3    | 1   |
| CO5 | 3    | 3    | 3    | 1    | 1    | 3    | 1   |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**

(w.e.f. 2019-20)

**ZOOLOGY SYLLABUS FOR IV SEMESTER**

**ZOOLOGY – PAPER – IV**

**EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**Unit – I**

**1.1 Developmental Biology and Embryology**

1.1.1 Gametogenesis

1.1.2 Fertilization

1.1.3 Types of eggs

1.1.4 Types of cleavages

1.2 Development of Frog upto formation of primary germ layers

1.3 Formation and functions of Foetal membrane in chick embryo

1.4 Development, types and functions of Placenta in mammals

**Unit – II**

**2.1 Physiology – I**

2.1.1 Elementary study of process of digestion

2.1.2 Absorption of digested food

2.1.3 Respiration – Pulmonary ventilation, transport of oxygen and carbondioxide

2.1.4 Circulation – Structure and functioning of heart, Cardiac cycle

2.1.5 Excretion – Structure of nephron, urine formation, counter current mechanism

**Unit – III**

**3.1 Physiology – II**

3.1.1 Nerve impulse transmission – Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers

3.1.2 Muscle contraction – Ultra structure of muscle fibre, molecular and chemical basis of muscle contraction

3.1.3 Endocrine glands – Structure, secretions and the functions (of hormones) of pituitary, thyroid, parathyroid, adrenal glands and pancreas

3.1.4 Hormonal control of reproduction in a mammal

## **Unit – IV**

### **4.1 Ecology – I**

4.1.1 Meaning and scope of Ecology

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

4.1.3 Nutrient cycles – Nitrogen, carbon and phosphorus

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

## **Unit – V**

### **5.1 Ecology – II**

5.1.1 Habitat and ecological niche

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

5.1.3 Ecological succession

5.1.4 Population studies

### **5.2 Zoogeography**

5.2.1 Zoogeographical regions

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

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A),  
VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 2020)  
SEMESTER – IV PAPER IV Hrs/week : 4  
EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY  
MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

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**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary.**

1. a. Define Gametogenesis. Describe the process of spermatogenesis with the help of neat labeled diagrams.

OR

b. Write an essay on the development of frog upto gastrulation.

2. a. Describe the physiology of digestion focusing on carbohydrates and lipids.

OR

b. Give an account of O<sub>2</sub> transport in animals.

3. a. Explain sliding filament mechanism of muscle contraction.

OR

b. Give an account of the hormonal control of female reproduction in Mammals

4. a. Describe the gaseous cycle of Nitrogen with the help of neat labeled diagrams.

OR

b. Write an essay on Energy flow in ecosystem.

5. a. Define ecological succession. Describe in detail the process of ecological succession.

OR

b. Describe the Geographical and faunal characters of Oriental region.

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Brief account of Oogenesis

7. Types of eggs

8. Hamburger's phenomenon

9. Action Potential

10. Parathyroid

11. Carbon cycle

12. Explain Mutualism with two examples

13. Australian region

□ □ □ □ □

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A),  
VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 2020)  
SEMESTER – IV PAPER IV Hrs/week : 3  
EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY  
(PRACTICAL SYLLABUS)**

**Periods: 24**

**Max. Marks: 50**

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**I. Embryology**

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)

**II. Physiology**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Qualitative tests for identification of ammonia, urea and uric acid
3. Study of activity of salivary amylase under optimum conditions
4. Study of prepared slides of T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
5. Digital alternative study of Breathing rate, Alimentary Canal, Heart Rate and Muscle Contraction using BioLab Frog and PhysioX 9.0 software

**III. Ecology**

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

## SEMESTER – 4

### Paper IV : Embryology, Physiology and Ecology

- CO1: Understanding the key events in embryonic development from gametes to gastrulation
- CO2: Acquisition of knowledge on functioning of various physiological aspects of the body
- CO3: Critical analysis of various endocrine glands and associated disorders and role of hormones in controlling the reproduction in mammals
- CO4: Understand and evaluate the key concepts in ecology with emphasis on role of biotic and abiotic factors, interactions among different species, concept of ecosystem, food chain and food web and community interactions.
- CO5: Critical study and evaluation of the underlying concept of distribution of animals on earth

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>  | <b>Knowledge level (Bloom's Taxonomy)</b>                                | <b>Average level weightage</b> |
|--|--|--------------------------------|
| CO1: Understanding the key events in embryonic development from gametes to gastrulation  | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 4 (Analyzing)   | 3.5                            |
| CO2: Acquisition of knowledge on functioning of various physiological aspects of the body  | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application) | 2                              |
| CO3: Critical analysis of various endocrine glands and associated disorders and role of hormones in controlling the reproduction in mammals  | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 4 (Analysing)    | 2.3                            |
| CO4: Understand and evaluate the key concepts in ecology with emphasis on role of biotic and abiotic factors, interactions among different species, concept of ecosystem, food chain and food web and community interactions and application of the concepts for a sustainable environment | Level 1 (Knowledge)<br>Level 4 (Analysing)<br>Level 5 (Evaluation)       | 3.3                            |

CO5: Critical study and evaluation of the underlying concept of distribution of animals on earth

Level 1 (Knowledge)  
Level 4 (Analysing)  
Level 5 (Evaluation)

3.3

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 3   | -   | -   | 3   | 1   | 2   | -   | 3   |
| CO2 | 3   | 1   | -   | -   | 2   | 3   | 1   | -   | 3   |
| CO3 | 3   | 3   | 2   | -   | 3   | 1   | 3   | 2   | 3   |
| CO4 | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   |
| CO5 | 3   | -   | -   | -   | 2   | 3   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 3    | 3    | -    | -    | 2    | 1    |
| CO2 | 2    | 2    | 3    | 3    | -    | 3    | -    |
| CO3 | 3    | 3    | 3    | -    | 1    | 3    | 1    |
| CO4 | 3    | 3    | 3    | 3    | 3    | 3    | 3    |
| CO5 | 3    | 3    | 3    | 3    | -    | 2    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR V SEMESTER**  
(w.e.f. 2019-20)

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

**Periods:60**

**Max. Marks:100**

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

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

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

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

**Unit 2 Techniques of Recombinant DNA technology**

**Cloning:** Use of linkers and adaptors

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

**PCR:** Basics of PCR.

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

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

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

**UNIT 3 Animal Cell Technology**

**Cell culture media:** Natural and Synthetic

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

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

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

**Unit 4 Reproductive Technologies & Transgenic Animals**

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

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

**Unit 5 Applied Biotechnology**

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

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



**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 2020)**

**SEMESTER – V**

**PAPER -V**

**Hrs/week : 4**

**ANIMAL BIOTECHNOLOGY**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Give a brief account of the different types of Restriction Endonucleases and add a note on the mode of action and applications of Type II restriction enzymes in genetic engineering.  
OR
- b. Explain the following Cloning vectors:
  - i. pBR series
  - ii. pUC series
2. a. Write an essay on different types of gene delivery mechanisms.  
OR
- b. Describe the southern blotting technique in detail.
3. a. Write an essay on natural and synthetic culture media.  
OR
- b. Give an account of the different types of stem cells and add note on their applications.
4. a. Explain the following techniques in brief:
  - i. *in vitro* fertilization
  - ii. Embryo transfer  
OR
- b. Write an essay on transgenic animals
5. a. Write an account of different types of Fermentation processes.  
OR
- b. Write an essay on application of biotechnology in aquaculture

**SECTION – B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. DNA Polymerase
7. DNA ligase
8. Basics of PCR
9. cDNA library
10. Cryopreservation
11. Hybridoma technology
12. Superovulation
13. Lyophilization



**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM**  
**ZOOLOGY SYLLABUS (W.E.F. 2019 – 2020)**

**SEMESTER – V**

**PAPER -V**

**Hrs/week : 3**

**ANIMAL BIOTECHNOLOGY (PRACTICAL SYLLABUS)**

**Periods: 24**

**Max. Marks: 50**

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Any SIX of the following:

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

**SUGGESTED READING**

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

**SEMESTER -5 paper-V**  
**Paper-V: ANIMAL BIOTECHNOLOGY**

- CO1: Understand the Principles of Cloning strategies, gain knowledge on enzymes and cloning vectors and their uses in gene cloning technologies.
- CO2: Understand the gene delivery mechanisms, to acquire skills in PCR, Sanger’s sequencing methods, blotting techniques.
- CO3: To acquaint students with latest biotechnology techniques like cell culture, tissue culture, stem cell technology and hybridoma technology to foster a spirit of inquiry and orientation to research
- CO4: Understanding the assistive reproductive technologies and production of transgenic animals.
- CO5: Understanding the applications of bio-technology in fields of Industry and Agriculture including animal cell and tissue culture.

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>   | <b>Knowledge level (Bloom’s Taxonomy)</b>                              | <b>Average level weightage</b> |
|---|--|--------------------------------|
| CO1: Understand the Principles of Cloning strategies, gain knowledge on enzymes and cloning vectors and their uses in gene cloning technologies   | Level 1 (Knowledge )<br>Level 2 (Understanding)                        | <b>1.5</b>                     |
| CO2: Understand the gene delivery mechanisms, to acquire skills in PCR, Sanger’s sequencing methods, blotting techniques  | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 4 (Analysing) | <b>2.3</b>                     |
| CO3: To acquaint students with latest biotechnology techniques like cell culture, tissue culture, stem cell technology and hybridoma technology to foster a spirit of inquiry and orientation to research | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 4 (Analysing)  | <b>2.3</b>                     |
| CO4: Understanding the assistive reproductive technologies and production of transgenic animals   | Level 3 (Application)<br>Level 4 (Analysing)<br>Level 5 (Evaluation)   | <b>4</b>                       |

CO5: Understanding the applications of biotechnology in fields of Industry and Agriculture including animal cell and tissue culture.

Level 2 (Knowledge)  
Level 3 (Application)  
Level 4 (Analysing)  
Level 5 (Evaluation)

3.5

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 3   | 1   | 1   | 3   | 2   | 3   | 2   | 3   |
| CO2 | 3   | 3   | 1   | 1   | 3   | 2   | 3   | 2   | 3   |
| CO3 | 3   | 3   | 1   | 1   | 3   | 2   | 3   | 2   | 3   |
| CO4 | 3   | 3   | 1   | 1   | 3   | 2   | 3   | 2   | 3   |
| CO5 | 3   | 3   | 1   | 1   | 3   | 2   | 3   | 2   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 3    | 2    | 2    | 1    | 3    | 3    |
| CO2 | 3    | 3    | -    | -    | 1    | 3    | 3    |
| CO3 | 3    | 3    | 3    | 1    | 1    | 3    | 3    |
| CO4 | 3    | 3    | 3    | 3    | 1    | 3    | 3    |
| CO5 | 3    | 3    | 3    | 1    | 1    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR V SEMESTER**  
(w.e.f. 2019-20)

**ZOOLOGY - PAPER - VI**  
**ANIMAL HUSBANDRY**

**UNIT – I** : **10 Hours**

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

**UNIT – II:** **10 Hours**

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

**UNIT – III:** **10 Hours**

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

**UNIT- IV:** **20 Hours**

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

**UNIT - V:** **10 Hours**

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

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019- 2020)**

**SEMESTER - V**

**PAPER-VI  
ANIMAL HUSBANDRY  
MODEL PAPER**

**Hrs/week : 4**

**Time: 3 hrs**

**Max. Marks: 60**

**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on the principles of poultry farming  
OR  
b. Discuss the various processes involved in management of chicks, growers and layers.
2. a. Write an essay on various nutritional requirements for layers and broilers at different stages of growth.  
OR  
b. Give an account of the different types of viral & bacterial diseases (2 each) affecting poultry with an emphasis on the symptoms, control and management of the diseases.
3. a. Write an essay on selection, care and handling of hatching eggs.  
OR  
b. Explain the process of brooding and rearing.
4. a. Give a detailed account of the criteria involved in selection of site for a dairy farm and add a brief note on different systems of housing.  
OR  
b. Describe the following:
  - i. Castration & Dehoming
  - ii. Deworming and Vaccination
5. a. Write an account of the care and management of calf and heifer.  
OR  
b. Write an essay on the care and management of bulls and bullocks.

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Poultry house
7. Broilers
8. Aspergillosis
9. Avian influenza
10. Sexing of chicks
11. Indian cattle breed varieties
12. Weaning of calf
13. Management of Dry and pregnant animal



**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM**  
**ZOOLOGY SYLLABUS (W.E.F. 2019- 2020)**

**SEMESTER - V**

**PAPER-VI**

**Hrs/week : 3**

**ANIMAL HUSBANDRY (PRACTICAL SYLLABUS)**

**Periods:24**

**Max. Marks: 50**

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

## SEMESTER-V

### PAPER – VI ANIMAL HUSBANDRY

- CO1: Understanding the key concepts of poultry farming with reference to poultry housing and management of poultry chicken which makes the student self-employable
- CO2: Knowledge on poultry feed and poultry diseases which helps the student to take up a start-up with a minimum investment for producing and supplying poultry feed
- CO3: Knowledge on hatching, selection, testing of poultry eggs and sexing of chicken
- CO4: Empower the student with the principles of dairy farming in terms of selection of site, dairy housing, identification of breeds and techniques involved in breeding so that he/she can get an employment in dairy industry
- CO5: Understand and acquire knowledge on the care and management of dairy animals

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>   | <b>Knowledge level (Bloom's Taxonomy)</b>   | <b>Average level weightage</b> |
|---|---|--------------------------------|
| CO1: Understanding the key concepts of poultry farming with reference to poultry housing and management of poultry chicken which makes the student self-employable  | Level1(Knowledge )<br>Level2(Understanding)   | <b>1.5</b>                     |
| CO2: Knowledge on poultry feed and poultry diseases which helps the student to take up a start-up with a minimum investment for producing and supplying poultry feed  | Level1(Knowledge )<br>Level2(Understanding)<br>Level3(Application)<br>Level4(Analysing) | <b>2.5</b>                     |
| CO3: Knowledge on hatching, selection, testing of poultry eggs and sexing of chicken  | Level1(Knowledge),<br>Level2(Understanding)   | <b>2.3</b>                     |
| CO4: Empower the student with the principles of dairy farming in terms of selection of site, dairy housing, identification of breeds and techniques involved in breeding so that he/she can get an employment in dairy industry | Level4(Analysing)<br>Level5(Evaluation)   | <b>4.5</b>                     |

CO5: Understand and acquire knowledge on the care and management of dairy animals

Level2(Understanding)  
Level3(Application),  
Level4(Analysing)  
Level5(Evaluation)

3.5

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 2   | 2   | 2   | 3   | 1   | 3   | 3   | 3   |
| CO2 | 3   | 2   | 2   | 2   | 3   | 1   | 3   | 3   | 3   |
| CO3 | 3   | 2   | 2   | 2   | 3   | 1   | 3   | 3   | 3   |
| CO4 | 3   | 2   | 2   | 2   | 3   | 1   | 3   | 3   | 3   |
| CO5 | 3   | 2   | 2   | 2   | 3   | 1   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | 1    | 3    | 3    | 3    | 3    |
| CO2 | 3    | 2    | 1    | 3    | 3    | 3    | 3    |
| CO3 | 3    | 2    | 1    | 3    | 3    | 3    | 3    |
| CO4 | 3    | 2    | 1    | 3    | 3    | 3    | 3    |
| CO5 | 3    | 2    | 1    | 3    | 3    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR VI SEMESTER**  
(w.e.f. 2019-20)

**ZOOLOGY –ELECTIVE PAPER:VII-(A)**

**IMMUNOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**Unit - I**

**1.1 Overview of Immune system**

- 1.1.1 Introduction to basic concepts in Immunology
- 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

**Unit - 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 influencing immunogenicity

**Unit - III**

**3.1 Antibodies**

- 3.1.1 Structure of antibody
- 3.1.2 Classes and functions of antibodies
- 3.1.3 Monoclonal antibodies

**Unit - IV**

**4.1 Working of Immune system**

- 4.1.1 Structure and functions of major histocompatibility complexes
- 4.1.2 Exogenous and Endogenous pathways of antigen presentation and processing
- 4.1.3 Basic properties and functions of cytokines

**Unit - V**

**5.1 Immune system in health and disease**

- 5.1.1 Classification and brief description of various types of hyper sensitivities
- 5.1.2 Introduction to concepts of autoimmunity and immunodeficiency

**5.2 Vaccines**

- 5.2.1 General introduction to vaccines
- 5.2.2 Types of vaccines



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ZOOLOGY SYLLABUS (W.E.F. 2019 – 18)**

**SEMESTER – VI**

**PAPER - VII \***

**Hrs/week : 4**

**ELECTIVE PAPER: VII-(A)\* : IMMUNOLOGY**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks:**

**60**

---

**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on acquired immunity.

OR

b. Give an account of the different types of organs of the immune system.

2. a. Define antigen. Explain the structure and properties of antigens.

OR

b. Explain the different factors influencing immunogenicity.

3. a. Give a detailed account of the structure of antibodies with neat, labeled diagrams.

OR

b. Explain any 4 antigen-antibody reactions in detail.

4. a. Write an account on the structure and functions of major histocompatibility complexes.

OR

b. Write an essay on the exogenous and endogenous pathways of antigen presentation & processing.

5. a. Describe various types of hypersensitivity briefly, with diagrams.

OR

b. Write an essay on different types of vaccines.

**SECTION – B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Innate Immunity

7. T - Lymphocytes

8. B and T cell epitopes, Haptens, Adjuvants – Definition & Examples only

9. Functions of Antibodies

10. Cytokines

11. Autoimmunity

12. Immunodeficiency

13. Immunization programme

□ □ □ □ □

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VISA KHAPATNAM**

**ZOOLOGY SYLLABUS (W.E.F. 2019 – 18)**

**SEMESTER – VI**

**PAPER – VII\***

**Hrs/week : 3**

**ELECTIVE PAPER: VII-(A)\* : IMMUNOLOGY**

**(PRACTICAL SYLLABUS)**

**Periods: 24**

**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. Immunoelectrophoresis

## SEMESTER-V

### PAPER – VII A IMMUNOLOGY

CO1: Overview of the immune system including organs, cells and types of Immunity

CO2: Understand the concept of foreignness of antigen and receptors and factors associated with immunogenicity

CO3: Understanding the role of antibodies (immunoglobulins) in immunity and applications of monoclonal antibodies

CO4: Understand the role of Major histocompatibility complexes and cytokines in controlling the growth and activity of other immune system cells and blood cells

CO5: Knowledge on the key concepts of immune disorders associated with autoimmunity and hypersensitivity and apply the knowledge in combating various diseases through vaccines

| Learning Outcomes: On Completion of the course, the students will be able to  | Knowledge level (Bloom's Taxonomy)                                       | Average level weightage |
|---|--|-------------------------|
| CO1: Overview of the immune system including organs, cells and types of Immunity  | Level 1 (Knowledge )<br>Level 2 (Understanding)                          | 1.5                     |
| CO2: Understand the concept of foreignness of antigen and receptors and factors associated with immunogenicity  | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application) | 1.5                     |
| CO3: Understanding the role of antibodies (immunoglobulins) in immunity and applications of monoclonal antibodies   | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)  | 2.0                     |
| CO4: Understand and analyze the role of Major histocompatibility complexes and cytokines in controlling the growth and activity of other immune system cells and blood cells                  | Level 2 (Understanding)<br>Level 4 (Analyzing)                           | 3.0                     |
| CO5: Knowledge on the key concepts of immune disorders associated with autoimmunity and hypersensitivity, apply the knowledge in combating various diseases through vaccines and evaluate the | Level 1 (Knowledge)<br>Level 3 (Application)<br>Level 5 (Evaluation)     | 3.0                     |

health benefits thereof

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 2   | -   | 1   | 2   | 1   | -   | -   | 3   |
| CO2 | 3   | 2   | -   | -   | 2   | 1   | -   | -   | 3   |
| CO3 | 3   | 2   | -   | -   | 2   | 1   | -   | -   | 3   |
| CO4 | 3   | 2   | -   | -   | 2   | 1   | -   | -   | 3   |
| CO5 | 3   | 2   | 3   | 1   | 2   | 1   | 1   | 1   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 3    | 1    | -    | 1    | 3    | 1    |
| CO2 | 3    | 3    | 1    | -    | 1    | 3    | 1    |
| CO3 | 3    | 3    | 1    | -    | 1    | 3    | 1    |
| CO4 | 3    | 3    | -    | -    | 1    | 3    | -    |
| CO5 | 3    | 3    | 1    | -    | 1    | 3    | 1    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR VI SEMESTER**  
(w.e.f. 2019-20)

**ZOOLOGY – ELECTIVE PAPER: VII-(B)**

**CELLULAR METABOLISM AND MOLECULAR BIOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**Unit I: Biomolecules**

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

**Unit II: Enzymes and Cellular Metabolism**

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

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

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

**Unit – V: Gene Expression**

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

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 18)**

**SEMESTER – VI**

**PAPER – VII\***

**Hrs/week : 4**

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

**CELLULAR METABOLISM AND MOLECULAR BIOLOGY  
MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. Write an essay on the classification of proteins.

OR

Describe the Watson & Crick model of DNA and functions of DNA.

2. Explain the different reactions involved in Krebs's cycle and add a note on its energy budget.

OR

Write an essay on Oxidative Phosphorylation of glucose.

3. Give an account of the  $\beta$  - oxidation of palmitic acid.

OR

Write an essay on the protein metabolism with an emphasis on transamination & Deamination.

4. Give a detailed account of the transport functions of plasma membrane.

OR

Write an essay of different types of cell junctions with neat, labeled diagrams.

5. Write an essay on the mechanism of gene expression in Prokaryotes.

OR

Define and explain the mechanism of transcription.

**SECTION – B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Structure of Glucose

7. Types of RNA

8. Enzyme classification

9. Gluconeogenesis

10. Urea cycle

11. Osmosis

12. Central Dogma

13. Elongation in Translation

□ □ □ □ □

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 18)**

**SEMESTER – VI**

**PAPER – VII\***

**Hrs/week : 3**

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

**CELLULAR METABOLISM AND MOLECULAR BIOLOGY  
(PRACTICAL SYLLABUS)**

**Periods: 24**

**Max. Marks: 50**

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1. Qualitative tests to identify functional groups of carbohydrates in given Solutions (Glucose, Fructose, Sucrose, Lactose)
2. Estimation of total protein in given solutions by Lowry's method.
3. Preparation of permanent slide to show the presence of Barr body in Human female blood cells or cheek cells
4. Estimation of DNA (colorimetric or spectrophotometric method)

**SUGGESTED READINGS**

- J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition .W.H. Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IVEdition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Karp, G. (2010), Cell and molecular biology : Concepts and experiments. VI edition. John Wiley and sons. Inc.
- De Robertis, EDP and De Robertis EMF (2006). Cell and molecular biology. VIII edition. Lippincott Williams and Wilkins, Philadelphia Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

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

### **CELLULAR METABOLISM AND MOLECULAR BIOLOGY**

CO1: To understand the importance, basic structure and configuration of biomolecules of living organisms

CO2: Understand the role of enzymes as biocatalysts in various metabolic activities and bioenergetics of carbohydrate metabolism

CO3: Appreciate the metabolic fate of lipids and proteins and transport properties of plasma membrane

CO4: Knowledge on the molecular concepts of cell physiology

CO5: Understand and evaluate the molecular basis of expression of genes in prokaryotes and eukaryotes and the key concepts of transcription and translation

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>  | <b>Knowledge level (Bloom's Taxonomy)</b>                                   | <b>Average level weightage</b> |
|--|---|--------------------------------|
| <b>CO1: To understand the importance, basic structure and configuration of biomolecules of living organisms</b>  | Level 1 (Knowledge )<br>Level 2 (Understanding)                             | <b>1.5</b>                     |
| <b>CO2: Understand the role of enzymes as biocatalysts in various metabolic activities and bioenergetics of carbohydrate metabolism</b>                            | Level 1 (Knowledge )<br>Level 2 (Understanding)                             | <b>1.5</b>                     |
| <b>CO3: Appreciate the metabolic fate of lipids and proteins and transport properties of plasma membrane</b>   | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)     | <b>2.0</b>                     |
| <b>CO4: Knowledge on the molecular concepts of cell physiology</b>   | Level 2 (Understanding)<br>Level 4 (Analyzing)                              | <b>3.0</b>                     |
| <b>CO5: Understand and evaluate the molecular basis of expression of genes in prokaryotes and eukaryotes and the key concepts of transcription and translation</b> | <b>Level 1 (Knowledge)</b><br>Level 3 (Application)<br>Level 5 (Evaluation) | <b>3.0</b>                     |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 1   | -   | -   | 1   | 2   | 1   | 1   | 3   |
| CO2 | 3   | 1   | -   | -   | 1   | 2   | 1   | 1   | 3   |
| CO3 | 3   | 1   | -   | -   | 1   | 1   | 1   | 1   | 3   |
| CO4 | 3   | 1   | -   | -   | 1   | 1   | 1   | 1   | 3   |
| CO5 | 3   | 1   | -   | -   | 1   | 1   | 1   | 1   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 1    | -    | 1    | -    | 3    | -    |
| CO2 | 3    | 1    | -    | 1    | -    | 3    | -    |
| CO3 | 3    | 1    | -    | 1    | -    | 3    | -    |
| CO4 | 3    | 1    | -    | 1    | -    | 3    | -    |
| CO5 | 3    | 1    | -    | 1    | -    | 3    | -    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR VI SEMESTER**  
(w.e.f. 2019-20)

**ZOOLOGY - ELECTIVE PAPER: VII-(C)**  
**BIOINFORMATICS**

**Periods: 60**

**Max. Marks: 100**

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**UNIT I - HISTORY, SCOPE AND IMPORTANCE** (10 hours)

Important contributions - aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities - internet basics- HTML introduction to NCBI data model- Various file formats for biological sequences

**UNIT II - DATABASES - TOOLS AND THEIR USES** (15 hours)

Importance of databases - Biological databases-primary sequence databases; Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases - bibliographic databases - specialized genomic resources- analysis packages

**UNIT III - SEQUENCE ALIGNMENT METHODS** (15 hours)

Sequence analysis of biological data-Significance of sequence alignment pair wise sequence alignment methods- Use of scoring matrices and gap penalties in sequence alignments- multiple sequence alignment methods - Tools and application of multiple sequence alignment.

**UNIT IV - PREDICTIVE METHODS USING DNA AND PROTEIN SEQUENCES**

(10 hours)

Gene predictions strategies - protein prediction strategies - molecular visualization tools- phylogenetic analysis: Concept of trees- phylogenetic trees and multiple alignments.

**UNIT V - DRUG DISCOVERY PROCESS** (10 hours)

Discovering a drug - target identification and validation - identifying the lead compound - optimization of lead compound - chemical libraries.

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 18)**

**SEMESTER – VI**

**PAPER – VII\***

**Hrs/week : 4**

**ELECTIVE PAPER: VII-(C)\***

**BIOINFORMATICS**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on applications of bioinformatics & add a note on the challenges & opportunities.  
OR
- b. Describe in detail various file formats for biological sequence.
2. a. Give an account of primary and secondary sequence databases.  
OR
- b. Explain the following:
  - i. Structure databases
  - ii. Bibliographic databases
3. a. Write an essay on the sequence analysis of biological data.  
OR
- b. Describe the different tools and application of multiple sequence alignment.
4. a. Explain the following:
  - i. Gene Prediction Strategies
  - ii. Protein Prediction Strategies  
OR
- b. Write an essay on Phylogenetic analysis.
5. a. Write an essay on the discovery, target identification and validation of a drug.  
OR
- b. Give an account of the identification and optimization of the lead compound.

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Aims and tasks of Bioinformatics
7. HTML
8. Protein sequence databases
9. Specialized genomic resources
10. Sequence analysis – Definition and significance
11. Use of Scoring Matrices in sequence alignments
12. Molecular visualization tools
13. Chemical libraries

□ □ □ □ □

## ZOOLOGY - ELECTIVE PAPER: VII-(C)

### BIOINFORMATICS

CO1: To understand the evolution of the concept of bioinformatics

CO2: Demonstrate different biological databases and tools

CO3: Knowledge on sequence alignment methods

CO4: Analyze the phylogenetic tree algorithms and predict gene and protein structure

CO5: Apply the concepts of bioinformatics in drug discovery

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>             | <b>Knowledge level (Bloom's Taxonomy)</b>                               | <b>Average level weightage</b> |
|---|---|--------------------------------|
| CO1: To understand the evolution of the concept of bioinformatics                               | Level 1 (Knowledge )<br>Level 2 (Understanding)                         | 1.5                            |
| CO2: Demonstrate different biological databases and tools                                       | Level 1 (Knowledge )<br>Level 2 (Understanding)                         | 1.5                            |
| CO3: Knowledge on sequence alignment methods and application of the tools on biological samples | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application) | 2.0                            |
| CO4: Analyze the phylogenetic tree algorithms and predict gene and protein structure            | Level 2 (Understanding)<br>Level 4 (Analyzing)                          | 3.0                            |
| CO5: Apply the concepts of bioinformatics in drug discovery                                     | Level 1 (Knowledge)<br>Level 3 (Application)                            | 2.0                            |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 |     |     |     |     |     |     | 3   | 3   | 3   |
| CO2 |     |     |     |     |     |     | 3   | 3   | 3   |
| CO3 |     |     |     |     |     |     | 3   | 3   | 3   |
| CO4 |     |     |     |     |     |     | 3   | 3   | 3   |
| CO5 |     |     |     |     |     |     | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 1    | -    | 2    | -    | 3    | 3    |
| CO2 | 3    | 1    | -    | 2    | -    | 3    | 3    |
| CO3 | 3    | 1    | -    | 2    | -    | 3    | 3    |
| CO4 | 3    | 1    | -    | 2    | -    | 3    | 3    |
| CO5 | 3    | 1    | -    | 2    | -    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-A: VI SEMESTER**  
(w.e.f. 2019-20)  
**MEDICAL DIAGNOSTICS**

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

**CLINICAL BIOCHEMISTRY**

**Periods: 60**

**Max. Marks: 100**

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**UNIT – I: Basic Medical Laboratory Principles and Procedures: 10 Hours**

Introduction to clinical biochemistry. Glassware. Solutions and Reagents – Normal, Molar, percent, buffer solutions and indicators. Equipments and Instruments – Centrifuges, Hot air oven, Incubator, Water bath, Photometer, Spectrophotometer, Analyzers. Quality Control.

**UNIT – II: Clinical Biochemistry of Carbohydrates, Proteins & Lipids: 20 Hours**

Elementary classification and metabolism of carbohydrates. Properties of carbohydrates. Regulation of blood sugar and Diabetes. Glucose Tolerance Test. Glycosylated Haemoglobin. General classification of proteins. Structure of proteins. Summary of protein digestion and aminoacid metabolism. Determination of serum proteins. General lipid metabolism. Primary and Secondary Dyslipoproteinemias.

**UNIT – III: Clinical Biochemistry of Enzymes: 10 Hours**

Enzymes as catalysts. Enzyme specificity. Factors which affect enzyme activity. Coenzymes and Isoenzymes. Enzymes classification and nomenclature. Enzymes in clinical diagnosis. Use of enzymes as reagents. Laboratory determinations of enzymes – Clinical significance of SGOT, SGPT, S.ALP, S.ACP, Serum Amylase.

**UNIT- IV: Water & Mineral Metabolism and Acid-Base Balance: 10 Hours**

Body fluid distribution. Factors which influence the distribution of body water. Mineral metabolism. Importance of the trace elements. Flame photometry. Action of buffer systems. Disturbances in acid-base balance

**UNIT - V: Function Tests: 10 Hours**

Diseases of the kidneys. Creatine metabolism. Bile pigment metabolism. Disordered Bilirubin metabolism. Hepatic Jaundice and Post hepatic jaundice. Ischemic heart disease. Clinical significance of gastric analysis.

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI            CLUSTER PAPER – VIII\*            Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-A\* : MEDICAL DIAGNOSTICS**

**VIII-A-1\* : CLINICAL BIOCHEMISTRY**

**MODEL PAPER**

**Time : 3 hrs**

**Max. Marks : 60**

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**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on various instruments used in clinical Bio - Chemistry  
OR  
b. Explain Protein digestion and Amino Acid Metabolism
2. a. Write an essay on Carbohydrate Metabolism  
OR  
b. Explain in detail Lipid Metabolism
3. a. Explain the importance of enzymes in clinical diagnosis  
OR  
b. Explain the following:
  - i. Enzyme Specificity
  - ii. Factors affecting enzyme activity
4. a. Write an essay on action Buffer systems and disturbance in acid – base balance  
OR  
b. Write an essay on body fluid distribution and factors which influence it
5. a. Write an essay on the diseases of kidney  
OR  
b. Write an essay on the hepatic jaundice and post hepatic jaundice complications

**SECTION - B**

**Answer any FIVE of the following :**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Incubator
7. Properties of Carbohydrates
8. Glucose tolerance Test
9. Co - Enzymes
10. Enzymes Nomenclature
11. Importance of trace elements
12. Ischemic heart disease
13. Clinical significance of gastric analysis

□ □ □ □ □

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-A\* : MEDICAL DIAGNOSTICS**

**VIII-A-2\* : HAEMATOLOGY**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

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**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on collection of blood anticoagulants and their effects

OR

b. Write an essay on the composition of blood with the help of neat labeled diagrams

2. a. Write an essay on hemopoiesis

OR

b. Explain the procedure and clinical significance of total RBC count and ESR

3. a. Describe in detail various types of anemia

OR

b. Write an essay on the structure and life cycle of *Wuchereria bancrofti*

4. a. Write an essay on the mechanism of blood coagulation and importance of routine coagulation tests

OR

b. Give an account of different types of Leukemia.

5. a. Write an essay on automation in hematology

OR

b. Write an essay on human blood group systems and inheritance of these systems

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Effects of storage on blood

7. Types of haemoglobin

8. Total leucocyte count

9. HDNB

10. Thalassemia

11. Structure of *Plasmodium vivox*

12. Blood cell counter

13. Blood transfusion problems

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## Cluster Elective Paper: VIII-A-1

### CLINICAL BIOCHEMISTRY

CO1: Knowledge on the preparation of different types of solutions and usage of different equipment

CO2: Understand the clinical aspects of carbohydrates, proteins and lipids

CO3: Analysis of enzymes of clinical importance and diagnosis

CO4: Understand the core concepts of importance of minerals and acid-base balance in health

CO5: Analysis and evaluation of stomach, kidney and heart related clinical parameters

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>                | <b>Knowledge level (Bloom's Taxonomy)</b>                              | <b>Average level weightage</b> |
|--|--|--------------------------------|
| CO1: Knowledge on the preparation of different types of solutions and usage of different equipment | Level 1 (Knowledge )<br>Level 2 (Understanding)                        | <b>1.5</b>                     |
| CO2: Understand the clinical aspects of carbohydrates, proteins and lipids                         | Level1(Knowledge )<br>Level2(Understanding)                            | <b>1.5</b>                     |
| CO3: Analysis of enzymes of clinical importance and diagnosis                                      | Level 1 (Knowledge)<br>Level 3 (Application)<br>Level 4 (Analysing)    | <b>2.7</b>                     |
| CO4: Understand the core concepts of importance of minerals and acid-base balance in health        | Level 2 (Understand)<br>Level 4 (Analysing)                            | <b>3.0</b>                     |
| CO5: Analysis and evaluation of stomach, kidney and heart related clinical parameters              | Level 2 (Understanding)<br>Level 4 (Analysing)<br>Level 5 (Evaluation) | <b>3.7</b>                     |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 2   | -   | -   | 3   | -   | 3   | 1   | 3   |
| CO2 | 3   | 2   | -   | -   | 3   | -   | 3   | 1   | 3   |
| CO3 | 3   | 2   | -   | -   | 3   | -   | 3   | 1   | 3   |
| CO4 | 3   | 2   | -   | -   | 3   | -   | 3   | 1   | 3   |
| CO5 | 3   | 2   | -   | 1   | 3   | -   | 3   | 1   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 3    | 3    | 1    | -    | 3    | 3    |
| CO2 | 3    | 3    | 3    | 1    | -    | 3    | 3    |
| CO3 | 3    | 3    | 3    | 1    | -    | 3    | 3    |
| CO4 | 3    | 3    | 3    | 1    | -    | 3    | 3    |
| CO5 | 3    | 3    | 3    | 1    | -    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-A: VI SEMESTER**  
(w.e.f. 2019-20)  
**MEDICAL DIAGNOSTICS**

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

**HAEMATOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**UNIT – I: Laboratory Preparation in Haematology: 10 Hours**

Introduction to practical. Basic requirements. Collection of blood. Anticoagulants and effects of anticoagulants on blood cell morphology. Effects of storage of blood.

**UNIT – II: Routine Haematology: 15 Hours**

Composition of blood. Haemoglobin synthesis. Various haemoglobins. Haemopoietic system of the body. Blood cell counts. Erythropoiesis, Leucopoiesis and development of blood corpuscles. Thrombopoiesis. Laboratory technique of haemocytometry. Clinical significance of Total erythrocyte count, total leucocyte count, differential count, erythrocyte sedimentation rate and platelet count.

**UNIT – III: Haemostasis and Haematological Diseases: 15 Hours**

General consideration of blood coagulation. Mechanism of coagulation. The fibrinolytic mechanism. Clinical significance of routine coagulation tests. Anaemia. Various types of anaemias – Iron deficiency anaemia, Aplastic anaemia, Perinicious anaemia, Sideroblastic anaemia and Sickel cell anaemia. Other haematological diseases – HDNB, Thalassaemia, Leukaemia. Parasitic infections of blood – structure and life cycle of Plasmodium vivax, types of malaria, Structure and life cycle of Wuchereria bancrofti.

**UNIT- IV: Automation in Haematology: 10 Hours**

General considerations. Blood cell counters. Flow through cytochemical differential counter. Automated coagulated systems.

**UNIT - V: Immunohaematology and Blood banking: 10 Hours**

Human Blood Group Systems. Inheritance of blood group systems. Blood transfusion.

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 18)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-A\* : MEDICAL DIAGNOSTICS**

**VIII-A-2\* : HAEMATOLOGY**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

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**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on collection of blood anticoagulants and their effects

OR

- b. Write an essay on the composition of blood with the help of neat labeled diagrams

2. a. Write an essay on hemopoiesis

OR

- b. Explain the procedure and clinical significance of total RBC count and ESR

3. a. Describe in detail various types of anemia

OR

- b. Write an essay on the structure and life cycle of *Wuchereria bancrofti*

4. a. Write an essay on the mechanism of blood coagulation and importance of routine coagulation tests

OR

- b. Give an account of different types of Leukemia.

5. a. Write an essay on automation in hematology

OR

- b. Write an essay on human blood group systems and inheritance of these systems

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Effects of storage on blood

7. Types of haemoglobin

8. Total leucocyte count

9. HDNB

10. Thalassemia

11. Structure of *Plasmodium vivox*

12. Blood cell counter

13. Blood transfusion problems

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## Cluster Elective Paper: VIII-A-2

### HAEMATOLOGY

CO1: Understanding the basic requirements for the conduct of laboratory preparation of blood

CO2: Analysis of blood components and complete blood picture

CO3: Understand and Analyze the blood clotting mechanism and various haematological disorders

CO4: Analyze the blood parameters using automation

CO5: Understand the significance of blood donation and transfusion

| <b>Learning Outcomes:On Completion of the course, the students will be able to</b>            | <b>Knowledge level (Bloom's Taxonomy)</b>                               | <b>Average level weightage</b> |
|---|---|--------------------------------|
| CO1: Understanding the basic requirements for the conduct of laboratory preparation of blood  | Level 1 (Knowledge )<br>Level 2 (Understanding)                         | <b>1.5</b>                     |
| CO2: Analysis of blood components and complete blood picture                                  | Level 1 (Knowledge)<br>Level 4 (Analysing)                              | <b>2.5</b>                     |
| CO3: Understand and Analyze the blood clotting mechanism and various haematological disorders | Level 2 (Understanding)<br>Level 3 (Application)<br>Level 4 (Analysing) | <b>3.3</b>                     |
| CO4: Analyze the blood parameters using automation  | Level 3 (Application)<br>Level 4 (Analysing)                            | <b>3.5</b>                     |
| CO5: Understand the significance of blood donation and transfusion                            | Level 2 (Understanding)<br>Level 3 (Application)                        | <b>2.5</b>                     |

**CO-PO Mapping****1-Low, 2-Moderate, 3-High, '-' No Correlation**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 |     |     |     |     |     |     |     |     |     |
| CO2 |     |     |     |     |     |     |     |     |     |
| CO3 |     |     |     |     |     |     |     |     |     |
| CO4 |     |     |     |     |     |     |     |     |     |
| CO5 |     |     |     |     |     |     |     |     |     |

**CO-PSO Mapping****1-Low, 2-Moderate, 3-High, '-' No Correlation**

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | 1    | -    | -    | 3    | 3    |
| CO2 | 3    | 2    | 1    | -    | -    | 3    | 3    |
| CO3 | 3    | 2    | 1    | -    | -    | 3    | 3    |
| CO4 | 3    | 2    | 1    | 2    | -    | 3    | 3    |
| CO5 | 3    | 2    | 1    | -    | 3    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-A: VI SEMESTER**  
(w.e.f. 2019-20)

**MEDICAL DIAGNOSTICS**

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**Cluster Elective Paper: VIII-A-3**

**CLINICAL MICROBIOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**UNIT – I: Introduction to Clinical Microbiology: 10 Hours**

Introduction to microbiology. Introduction to bacteriology. Classification of bacteria. Basic features of bacteria. Factors influencing the growth of bacteria. Morphology of bacteria. Normal bacterial flora of the body. Pathogenic microorganisms.

**UNIT – II: Clinical Bacteriology Laboratory & Staining methods: 15 Hours**

Requirements of a microbiological lab -- safe disposal strategies. Safety practices to be followed in a microbiological laboratory. Sterilization and disinfection. Requirements in a microbiological lab. Microscopy. Automation in Bacteriology. Introduction to Staining. Gram Staining. Acid-Fast Staining. Capsule Staining. Transfer of bacteria.

**UNIT – III: Culturing of Microorganisms and Identification of Bacteria: 15 Hours**

Composition of culture media. Different types of culture media. Preparation of culture media. Inoculation of culture media. Culturing of anaerobes and different types of culture media used. Use, preparation and quality control of various culture media. Identification of bacteria – staining reactions, cultural characteristics and biochemical properties. Study of Gram Negative Bacteria – Bacilli and Cocci. Study of Gram Positive Bacteria – Gram positive Cocci, Anaerobic bacteria, study of genus – Bacillus and Corynebacterium. Study of Mycobacteria, Spirochetes and Rickettsia. Basic sterilization principles - autoclaving.

**UNIT- IV: Clinical Mycology and Virology: 10 Hours**

Basic morphological classification of clinically important fungi. Parasitic fungi – Superficial Mycoses and Dermatophytes, Subcutaneous Mycoses, Intermediate Superficial Deep Mycoses and Deep or Systemic mycoses. Classification based on symptomatology. Some important viruses and related diseases (Measles viruses, Influenza viruses, Rotaviruses, Polioviruses, Herpes viruses, Rabies viruses, Hepatitis viruses. . General transmission routes for viruses.

**UNIT - V: Diagnostic Serology:**

**10 Hours**

General view of immune system. Antibodies. Harmful effect of immunity. Autoimmune diseases. Principles of Serodiagnostic tests - Flocculation test, Agglutination test, Slide agglutination test, Tube agglutination test, Complement test, Micro titration test, Precipitin test and ELISA.

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-A\* : MEDICAL DIAGNOSTICS**

**VIII-A-3\* : CLINICAL MICROBIOLOGY**

**MODEL PAPER**

**Time: 3 hrs**

**Max. Marks: 60**

**SECTION - A**

**Answer any FIVE of the following:**

**5X8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on the morphology of bacteria and factors influencing their growth  
OR  
b. Describe the normal bacterial flora of the body and any two pathogenic micro - organisms
2. a. Write an essay on the requirements in a microbiological lab  
OR  
b. Write an essay on staining of bacteria
3. a. Write an essay on the composition and types of culture media  
OR  
b. Explain the clinical importance of Bacillus and Corynebacterium
4. a. Write an essay on parasitic Fungi  
OR  
b. Explain the chemical importance of Measles, Influenza and Hepatitis virus
5. a. Explain the structure, properties and functions of antibody  
OR  
b. Write an essay on the various types serodiagnostic tests

**SECTION - B**

**Answer any FIVE of the following:**

**5X4=20**

**Draw labeled diagrams wherever necessary**

6. Basic features of Bacteria
7. Sterilisation
8. Safe disposal strategies
9. Gram negative bacteria
10. Autoclaving
11. Rotoviruses
12. Parasitic fungi
13. ELISA

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**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY PRACTICAL SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-A\* : MEDICAL DIAGNOSTICS**

**PRACTICAL SYLLABUS**

**Periods: 72 (24+24+24)**

**Max. Marks: 50 x 3 = 150**

24 Hrs                      **PRACTICAL – 1 CLINICAL BIOCHEMISTRY**                      50 M

- Collection of blood specimen and serum preparation.
- Blood glucose and urine glucose estimation.
- LFT, Kidney Function and Cardiac Profile tests.
- Determination of serum proteins, SGOT, SGPT, S.ALP, S.ACP
- Determination of sodium, potassium and chlorides

24 Hrs    **PRACTICAL – 2 HAEMATOLOGY & CLINICAL MICROBIOLOGY**    50 M

- Routine haematological tests – Blood smear preparation, TC, DC, ESR, Platelet count.
- Determination of Haemoglobin.
- Determination of PCV.
- Determination of bleeding time.
- Determination of blood clotting time.
- Blood Grouping.
- Preparation of nutrient agar, culture plates and isolation of bacteria on nutrient agar plate.
- Study of permanent slides of *Candida albicans*, *Enterobacter sps*, *Pseudomonas*, *Salmonella sps*, *Shigella sps*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Vibrio cholera*.
- Staining methods – Albert's and Gram's staining methods.
- Hepatitis test and Pregnancy test using ELISA
- VDRL qualitative and quantitative test.
- WIDAL slide agglutination and tube agglutination test.

**24 Hrs**

**PRACTICAL - III:PROJECT WORK**  
Associated with a Clinical Diagnostic Laboratory

**50 M**

### Cluster Elective Paper: VIII-A-3

## **CLINICAL MICROBIOLOGY**

CO1: Understanding the microenvironment around us

CO2: Application of techniques of safety disposal of microorganisms and analyse the bacterial samples by staining methods

CO3: Application of techniques for identifying the microorganisms

CO4: Knowledge on fungi, viruses and associated diseases

CO5: Application and evaluation of antigen-antibody reactions by employing various serological tests

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>                                       | <b>Knowledge level (Bloom's Taxonomy)</b>                                | <b>Average level weightage</b> |
|---|--|--------------------------------|
| CO1: Understanding the microenvironment around us   | Level 1 (Knowledge)<br>Level 2 (Understanding)                           | <b>1.5</b>                     |
| CO2: Application of techniques of safety disposal of microorganisms and analyse the bacterial samples by staining methods | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)  | <b>2.0</b>                     |
| CO3: Application of techniques for identifying the microorganisms   | Level 2 (Understanding)<br>Level 3 (Application)<br>Level 4 (Analysing)  | <b>3.0</b>                     |
| CO4: Knowledge on fungi, viruses and associated diseases  | Level 1 (Knowledge)<br>Level 2 (Understanding)                           | <b>1.5</b>                     |
| CO5: Application and evaluation of antigen-antibody reactions by employing various serological tests                      | Level 2 (Understanding)<br>Level 3 (Application)<br>Level 5 (Evaluation) | <b>3.3</b>                     |

**CO-PO Mapping****1-Low, 2-Moderate, 3-High, '-' No Correlation**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 1   | -   | -   | 1   | 2   | 1   | 1   | 3   |
| CO2 | 3   | 1   | -   | -   | 3   | 3   | 1   | 1   | 3   |
| CO3 | 3   | 1   | -   | -   | 1   | 1   | 1   | 1   | 3   |
| CO4 | 3   | 1   | -   | -   | 1   | 1   | 1   | 1   | 3   |
| CO5 | 3   | 1   | -   | -   | 1   | 1   | 1   | 1   | 3   |

**CO-PSO Mapping****1-Low, 2-Moderate, 3-High, '-' No Correlation**

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | -    | 1    | -    | 3    | 1    |
| CO2 | 3    | 2    | -    | 3    | -    | 3    | 3    |
| CO3 | 3    | 2    | -    | 1    | -    | 3    | 3    |
| CO4 | 3    | 2    | -    | 1    | -    | 3    | 1    |
| CO5 | 3    | 2    | -    | 1    | -    | 3    | 1    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-B: VI SEMESTER**  
(w.e.f. 2019-20)

## **AQUACULTURE**

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

## **PRINCIPLES OF AQUACULTURE**

**Periods: 60**

**Max. Marks: 100**

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### **Unit – I**

#### **1.1 Introduction / Basics of Aquaculture**

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

### **Unit – II**

#### **2.1 Types of Aquaculture**

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

#### **2.2 Culture systems**

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

#### **2.3 Culture practices**

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

### **Unit – III**

#### **3.1 Design and construction of aquafarms**

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

#### **3.2 Seed resources**

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

#### **3.3 Nutrition and feeds**

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

### **Unit – IV**

#### **4.1 Management of carp culture ponds**

- 4.1.1 Culture of Indian major carps: Pre-stocking management – Dewatering, drying, ploughing/desilting; Predators, weeds and algal blooms and their control, Liming and fertilization; Stocking management – Stocking density and stocking; Post-stocking

management – Feeding, water quality, growth and health care; and Harvesting of ponds  
**4.2 Culture of giant freshwater prawn, *Macrobrachium rosenbergii***

**Unit – V**

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

**5.2 Culture of pearl oysters**

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

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

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ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-B\* : AQUACULTURE**

**VIII-B-1\* : PRINCIPLES OF AQUACULTURE**

**MODEL PAPER**

**Time : 3 hrs**

**Max. Marks : 60**

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**SECTION - A**

**Answer any FIVE of the following :**

**5x8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on Species selection criteria in aquaculture and major freshwater cultivable species.

OR

- b. Give an account of aquaculture in Global scenario.

2. a. Write an essay on integrated aquaculture.

OR

- b. Describe the various culture practices of shrimp.

3. a. Write an essay on the natural seed resources and procurement of seed for carp.

OR

- b. Give an account of various natural and artificial feeds used in fish culture.

4. a. Explain the various pre-stocking pond management practices in carp culture.

OR

- b. Write an essay on freshwater prawn culture.

5. a. Write an essay on the shrimp culture.

OR

- b. Write an essay on pearl culture.

**SECTION - B**

**Answer any FIVE of the following :**

**5x4 =20**

**Draw labeled diagrams wherever necessary.**

6. Cultivable species of brackish water.  
7. Present status of aquaculture in India.  
8. Polyculture.  
9. Cage culture.  
10. Criteria for site selection.  
11. Artificial feeds.  
12. Algal blooms.  
13. Ornamental fishes.

## Cluster Elective Paper: VIII-B-1

### **PRINCIPLES OF AQUACULTURE**

CO1: Understanding the basics and history of aquaculture, identification of cultivable species and selection of site for aquaculture practices

CO2: Application of the knowledge of different types of aquaculture in various culture systems and practices

CO3: Create knowledge ecosystem in designing, construction and maintenance of aquafarms and appreciate the seed resources and nutritional requirements

CO4: Understand the culture of carps and shrimps and application of the knowledge in starting bio start-ups and make students self-employable

CO5: Application of culture aspects in cultivating sea weeds, shrimps, pearl oysters and ornamental fishes for aesthetic and economical purposes

| <b>Learning Outcomes:On Completion of the course, the students will be able to</b>   | <b>Knowledge level (Bloom's Taxonomy)</b>                                | <b>Average level weightage</b> |
|--|--|--------------------------------|
| CO1: Understanding the basics and history of aquaculture, identification of cultivable species and selection of site for aquaculture practices         | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2.0</b>                     |
| CO2: Application of the knowledge of different types of aquaculture in various culture systems and practices   | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)  | <b>2.0</b>                     |
| CO3: Create knowledge ecosystem in designing, construction and maintenance of aquafarms and appreciate the seed resources and nutritional requirements | Level 2 (Understanding)<br>Level 3 (Application)                         | <b>2.5</b>                     |

|  |  |            |
|--|--|------------|
| CO4: Understand the culture of carps and shrimps and application of the knowledge in starting bio start-ups and make students self-employable    | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application)<br>Level 6 (Create) | <b>3.0</b> |
| CO5: Application of culture aspects in cultivating sea weeds, shrimps, pearl oysters and ornamental fishes for aesthetic and economical purposes | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application)<br>Level 6 (Create) | <b>3.0</b> |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 1   | -   | -   | 1   | 3   | 3   | 3   | 3   |
| CO2 | 3   | 1   | -   | -   | 1   | 3   | 3   | 3   | 3   |
| CO3 | 3   | 1   | -   | -   | 1   | 3   | 3   | 3   | 3   |
| CO4 | 3   | 1   | -   | -   | 1   | 3   | 3   | 3   | 3   |
| CO5 | 3   | 1   | -   | -   | 1   | 3   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 1    | 1    | 1    | -    | 3    | 3    |
| CO2 | 3    | 1    | -    | 1    | -    | 3    | 3    |
| CO3 | 3    | 1    | -    | 1    | 2    | 3    | 3    |
| CO4 | 3    | 1    | 1    | 1    | -    | 3    | 3    |
| CO5 | 3    | 1    | 1    | 1    | -    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-B: VI SEMESTER**  
(w.e.f. 2019-20)

**AQUACULTURE**

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

**AQUACULTURE MANAGEMENT**

**Periods: 60**

**Max. Marks: 100**

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**Unit – I**

**1.1 Breeding and Hatchery Management**

- 1.1.1 Bundh Breeding and Induced breeding of carp by Hypophysation; and use of synthetic hormones
- 1.1.2 Types of fish hatcheries; Hatchery management of Indian major carps
- 1.1.3 Breeding and Hatchery management of *Penaeus monodon/ Litopenaeus vannamei*
- 1.1.4 Breeding and Hatchery management of giant freshwater prawn.

**Unit – II**

**2.1 Water quality Management**

- 2.1.1 Water quality and soil characteristics suitable for fish and shrimp culture
- 2.1.2 Identification of oxygen depletion problems and control mechanisms in culture ponds
- 2.1.3 Aeration: Principles of aeration and Emergency aeration
- 2.1.4 Liming materials, Organic manures and Inorganic fertilizers commonly used and their implications in fish ponds

**Unit – III**

**3.1 Feed Management**

- 3.1.1 Live Foods and their role in shrimp larval nutrition.
- 3.1.2 Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed additives and Preservatives; role of probiotics.
- 3.1.3 Feed formulation and manufacturing; Feed storage
- 3.1.4 Feeding strategies: Feeding devices, feeding schedules and ration size; Feed evaluation- feed conversion efficiencies and ratios

**Unit – IV**

**4.1 Disease Management**

- 4.1.1 Principles of disease diagnosis and health management;
- 4.1.2 Prophylaxis, Hygiene and Therapy of fish diseases
- 4.1.3 Specific and non-specific defense systems in fish; Fish immunization and vaccination
- 4.1.4 Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish ponds
- 4.1.5 Etiology, Symptoms, prophylaxis and therapy of common shrimp diseases in shrimp ponds

## **Unit – V**

### **5.1 Economics and Marketing**

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

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

### **5.2 Fisheries Extension**

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

### **5.3 Fish Genetics**

5.1.4 Genetic improvement of fish stocks – Hybridization of fish.

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

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-B\* : AQUACULTURE**

**VIII-B-2\* : AQUACULTURE MANAGEMENT**

**MODEL PAPER**

**Time : 3 hrs**

**Max. Marks : 60**

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**SECTION – A**

**Answer any FIVE of the following :**

**5x8=40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on induced breeding in major carps.  
OR  
b. Explain the hatchery management practices involved Penaeus monodon culture.
2. a. Give an account of soil and water quality parameters involved in fish culture.  
OR  
b. Write in detail various fertilizers and liming materials used in aquaculture.
3. a. Write an essay on the supplementary feeds.  
OR  
b. Write an essay on feeding strategies in aquaculture.
4. a. Write an essay on fish disease management.  
OR  
b. Explain the specific and non-specific defense mechanisms in fish.
5. a. Give a detailed account of Fisheries training and Education in India.  
OR  
b. Write an essay on the genetic improvement of fish stocks.

**SECTION – B**

**Answer any FIVE of the following :**

**5x4=20**

**Draw labeled diagrams wherever necessary**

6. Types of fish hatcheries.
7. Giant freshwater prawn breeding.
8. Oxygen depletion in aquaculture ponds.
9. Aeration.
10. Role of probiotics in aquaculture.
11. Fish health management.
12. Common shrimp diseases.
13. Fish marketing methods in India.

□ □ □ □ □

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

CO1: Understanding the concept of breeding of shrimps and management of shrimp hatchery

CO2: Understanding the importance of water quality and soil quality in culture ponds and application of aeration and liming principles for improving the quality respectively

CO3: Knowledge on Live feeds used in aquafarms and application of the knowledge in feed formulation and preparation

CO4: Understanding the health management of aqua farms, immunization and vaccination

CO5: Understanding economics, extension and marketing aspects of aquaculture application of genetics to fish reproduction and preservation of gametes

| <b>Learning Outcomes:On Completion of the course, the students will be able to</b>  | <b>Knowledge level (Bloom's Taxonomy)</b>                                | <b>Average level weightage</b> |
|---|--|--------------------------------|
| CO1: Understanding the concept of breeding of shrimps and management of shrimp hatchery   | Level 1 (Knowledge )<br>Level 2 (Understanding)                          | <b>1.5</b>                     |
| CO2: Understanding the importance of water quality and soil quality in culture ponds and application of aeration and liming principles for improving the quality respectively | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)  | <b>2.0</b>                     |
| CO3: Knowledge on Live feeds used in aquafarms and application of the knowledge in feed formulation and preparation   | Level 2 (Understanding)<br>Level 3 (Application)                         | <b>2.5</b>                     |
| CO4: Understanding the health management of aqua farms, immunization and vaccination  | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2.0</b>                     |
| CO5: Understanding economics, extension and marketing aspects of aquaculture application of genetics to fish reproduction   | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2.0</b>                     |

and preservation of gametes

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 2   | 1   | 3   | 3   | 3   | 3   | 3   | 3   |
| CO2 | 3   | 1   | 1   | 2   | 2   | 3   | 3   | 3   | 3   |
| CO3 | 3   | 1   | 1   | -   | 2   | 2   | 3   | 3   | 3   |
| CO4 | 3   | 1   | 1   | 1   | 2   | 2   | 3   | 3   | 3   |
| CO5 | 3   | 1   | 1   | 1   | 1   | 1   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | 1    | 1    | 3    | 3    | 3    |
| CO2 | 3    | 2    | 1    | 1    | 3    | 3    | 3    |
| CO3 | 3    | 2    | 1    | 1    | 3    | 3    | 3    |
| CO4 | 3    | 2    | 1    | 1    | 3    | 3    | 3    |
| CO5 | 3    | 2    | 1    | 1    | 3    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-B: VI SEMESTER**  
(w.e.f. 2019-20)

**AQUACULTURE**

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**Cluster Elective Paper: VIII-B-3**

**POST HARVEST TECHNOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**Unit – I**

**1.1 Handling and Principles of fish Preservation**

- 1.1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.
- 1.1.2 Principles of preservation– cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

**Unit – II**

**2.1 Methods of fish Preservation**

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

**Unit – III**

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

- 3.1.1 Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.
- 3.1.2 Fish by-products – fish glue, ising glass, chitosan, pearl essence, shark fins, fish leather and fish maws.

**3.2 Seaweed Products**

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

**Unit – IV**

**4.1 Sanitation and Quality control**

- 4.2.1 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.
- 4.2.2 Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.

**4.2 Regulatory affairs in industries**

## **Unit – V**

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

- 5.1.1 Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.
- 5.1.2 National and International standards – ISO 9000: 2000 Series of Quality Assurance System, *Codex Alimentarius*.

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-B\* : AQUACULTURE**

**VIII-B-3\* : POST HARVEST TECHNOLOGY**

**MODEL PAPER**

**Time : 3 hrs**

**Max. Marks : 60**

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**SECTION – A**

**Answer any FIVE of the following :**

**5x8=40**

**Draw labeled diagrams wherever necessary**

1. a. Explain the principles involved in the handling, storage and transport of fresh fish.  
OR  
b. Write an essay on the various principles in the fish preservation.
2. a. Write an essay on the traditional methods of fish preservation.  
OR  
b. Write an essay on the advanced methods of fish preservation.
3. a. Write in detail about the various by-products of fish.  
OR  
b. Give a detailed account of uses of seaweeds.
4. a. Explain about the sanitation aspects in processing plants.  
OR  
b. Write an essay on the Quality control procedures during and after processing of fish and fishery products.
5. a. Explain the Standard Operating Procedures (SOPs) and the Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.  
OR  
b. Write an essay on the National and International Standards in seafood Quality Assurance Systems.

**SECTION – B**

**Answer any FIVE of the following :**

**5x4=20**

**Draw labeled diagrams wherever necessary**

6. Spoilage in marine fish.
7. Fish preservatives
8. Traditional fish preservation methods.
9. Fish oil.
10. Preparation of Agar.
11. Regulatory affairs in industries.
12. GLPs.
13. *Codex Alimentaris*.

### **Cluster Elective Paper: VIII-B-3**

#### **POST HARVEST TECHNOLOGY**

CO1: Understanding the importance of handling, temperature, radiation and spoilage in fish preservation

CO2: Understanding the different types of traditional and advanced methods of fish preservation and application of the technology for self-employment

CO3: Application of the knowledge on the consumptive, economic and therapeutic value of fish products, fish byproducts and sea weed products

CO4: Understanding the significance of sanitation at personal and industry level and quality control of fishery products

CO5: Evaluation of processing industries based on national and international standards and understanding the maintenance of quality in industries

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>   | <b>Knowledge level (Bloom's Taxonomy)</b>                                | <b>Average level weightage</b> |
|---|--|--------------------------------|
| CO1: Understanding the importance of handling, temperature, radiation and spoilage in fish preservation   | Level 1 (Knowledge)<br>Level 2 (Understanding)                           | <b>1.5</b>                     |
| CO2: Understanding the different types of traditional and advanced methods of fish preservation and application of the technology for self-employment | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)  | <b>2.0</b>                     |
| CO3: Application of the knowledge on the consumptive, economic and therapeutic value of fish products, fish byproducts and sea weed products          | Level 2 (Understanding)<br>Level 3 (Application)<br>Level 5 (Evaluation) | <b>3.3</b>                     |
| CO4: Understanding the significance of sanitation at personal and industry level and quality control of fishery products                              | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 5 (Evaluation)  | <b>2.7</b>                     |

|   |   |     |
|---|---|-----|
| CO5: Evaluation of processing industries based on national and international standards and understanding the maintenance of quality in industries | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 5 (Evaluation) | 2.7 |
|---|---|-----|

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 1   | 1   | -   | 3   | 3   | 3   | 3   | 3   |
| CO2 | 3   | 1   | 1   | -   | 3   | 3   | 3   | 3   | 3   |
| CO3 | 3   | 1   | 1   | -   | 3   | 3   | 3   | 3   | 3   |
| CO4 | 3   | 1   | 1   | -   | 3   | 3   | 3   | 3   | 3   |
| CO5 | 3   | 1   | 1   | -   | 3   | 3   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 1    | 1    | 2    | -    | 2    | 2    |
| CO2 | 3    | 1    | 2    | 2    | 1    | 2    | 3    |
| CO3 | 3    | 1    | 1    | 2    | -    | 2    | 3    |
| CO4 | 3    | 1    |      | 3    | 1    | 2    | 3    |
| CO5 | 3    | 1    |      | 3    | 1    | 2    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-C: VI SEMESTER**  
(w.e.f. 2019-20)

**SERICULTURE**

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

**GENERAL SERICULTURE, MULBERRY CULTIVATION AND  
MANAGEMENT**

**Periods: 60**

**Max. Marks: 100**

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**Unit - I : Introduction**

- 1.1 Definition, history and present status of Sericulture
- 1.2 Types of silk worms and their food plants
- 1.3 Prospects of Sericulture in India - Sericulture industry in different states, employment, potential in mulberry and non mulberry Sericulture

**Unit - II : Morphology of mulberry plant**

- 2.1 Common varieties of mulberry used in India
- 2.2 Characters of root, stem and leaf
- 2.3 Anatomy of root, stem and leaf
- 2.4 Male and female reproductive organs, pollination, fertilization, development of seed.

**Unit - III : Requirements for mulberry cultivation**

- 3.1 Physical and chemical properties of soil and its nature
- 3.2 Soil moisture and water requirements
- 3.3 Climatic conditions - Temperature, photoperiod, humidity and rain fall

**Unit - IV : Mulberry management**

- 4.1 Land preparation - leveling and ploughing
- 4.2 Irrigation - drip, sprinkler or flood irrigation, weeding
- 4.3 Manuring - organic, inorganic and biofertilizers
- 4.4 Harvesting - leaf picking, shoot-leaf harvesting, branch cutting, leaf storage

**Unit - V : Diseases and pests of mulberry**

- 5.1 Fungal and bacterial diseases - Powdery mildew, red rust and leaf spot caused by fungi  
Mulberry wilt caused by bacteria  
Symptoms; mechanical and chemical control
- 5.2 Nematode and mycoplasma diseases - Mulberry root-knot and mulberry root rot (nematode diseases), Mycoplasma and viral mulberry disease, Symptoms; mechanical and chemical control
- 5.3 Caterpillars - Bihar hairy caterpillar, semilooper  
Bugs - Leaf hoppers and scale insects  
Beetles - Girdle beetle, powder pest beetle

## Cluster Elective Paper: VIII-C-1

### **GENERAL SERICULTURE, MULBERRY CULTIVATION AND MANAGEMENT**

CO1: Understanding the history, status and prospects of Sericulture in India

CO2: Understanding the morphology of mulberry plant in view of feeding the silk worm larvae

CO3: Analysis of physico-chemical properties of soil for mulberry cultivation

CO4: Application of irrigation, land farming, manuring and harvesting principles in mulberry management

CO5: Evaluation of diseases and pests of mulberry

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>                     | <b>Knowledge level (Bloom's Taxonomy)</b>                                | <b>Average level weightage</b> |
|---|--|--------------------------------|
| CO1: Understanding the history, status and prospects of Sericulture in India                            | Level 1 (Knowledge)<br>Level 2 (Understanding)                           | <b>1.5</b>                     |
| CO2: Understanding the morphology of mulberry plant in view of feeding the silk worm larvae             | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)  | <b>2.0</b>                     |
| CO3: Analysis of physico-chemical properties of soil for mulberry cultivation                           | Level 2 (Understanding)<br>Level 3 (Application)<br>Level 4 (Analysing)  | <b>3.0</b>                     |
| CO4: Application of irrigation, land farming, manuring and harvesting principles in mulberry management | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2.0</b>                     |
| CO5: Evaluation of diseases and pests of mulberry   | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 5 (Evaluation)  | <b>2.7</b>                     |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 2   | 1   | -   | 1   | 2   | 3   | 3   | 3   |
| CO2 | 3   | 2   | -   | -   | 1   | 2   | 3   | 3   | 3   |
| CO3 | 3   | -   | -   | -   | -   | -   | 3   | 3   | 3   |
| CO4 | 3   | 1   | 1   | 1   | 2   | 3   | 3   | 3   | 3   |
| CO5 | 3   | 1   | 1   | 1   | 2   | 3   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | 1    | 1    | -    | 3    | 3    |
| CO2 | 3    | 2    | 1    | 1    | -    | 3    | 3    |
| CO3 | 3    | 2    | 1    | 1    | -    | 3    | 3    |
| CO4 | 3    | 2    | 1    | 1    | -    | 3    | 3    |
| CO5 | 3    | 2    | 1    | 1    | -    | 3    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-C: VI SEMESTER**  
(w.e.f. 2019-20)

**SERICULTURE**

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

**BIOLOGY OF MULBERRY SILK WORM AND  
SILKWORM REARING TECHNOLOGY**

**Periods: 60**

**Max. Marks: 100**

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**Unit - I : Morphology of silk worm**

- 1.1 Egg - External and internal morphology and colour changes
- 1.2 Larva - Mouth parts, legs, prolegs, spiracles, eyes, claspers, integumentary hair and sexual markings
- 1.3 Pupa – Male and female morphology and sexual dimorphism
- 1.4 Adult – Mouth parts, antennae, wings and external genitalia

**Unit - II : Anatomy and physiology of Mulberry silk worm**

- 2.1 Digestive system of larva - Structure and physiology of digestion
- 2.2 Silk glands of larva – Structure, development and mechanism of silk synthesis
- 2.3 Circulatory system of larva – Blood vessel, haemolymph and cells
- 2.4 Reproductive system of adult – Mechanism of egg development
- 2.5 Endocrine glands in larva and pupa, their secretions and hormonal control on development
- 2.6 Roll of pheromone in mating

**Unit - III : Silk worm rearing house and appliances**

- 3.1 Construction of ideal rearing house (CSB model)
- 3.2 Early age rearing appliances
- 3.3 Late age rearing appliances – Trays, ant wells, stands and racks, paraffin papers, rubber foam pads, nets, chopsticks and feathers
- 3.4 Mountages – Bamboo, plastic, nylon, balances (digital)

**Unit - IV : Disinfection and feeding appliances and silk worm technology**

- 4.1 Disinfection of ants, appliances
- 4.2 Disinfectant appliances – Sprayers and dusters
- 4.3 Feeding appliances – Leaf chamber, chopping knife, chopping board
- 4.4 Humidity and temperature measuring devices
- 4.5 Commercial races – Multivoltine, bivoltine and hybrid races
- 4.6 Seed collection, cards, loose eggs, incubation, hatching, brushing, rearing of early instars, rearing of late instars
- 4.7 Mounting and cocoon production
- 4.8 Harvesting and storage of cocoons

**Unit - V : Diseases of silk worms and their management**

- 5.1 Viral diseases – Nuclear polyhydrosis disease, infectious flacherie viral disease (symptoms, prevention, control and management)
- 5.2 Protozoan disease – Pebrine disease (symptoms, prevention, control and management)
- 5.3 Bacterial diseases – Septicemia, Toxicosis (symptoms, prevention, control and management)
- 5.4 Fungal diseases – Muscardine disease, aspergillosis (symptoms, prevention, control and management)
- 5.5 Pests – Tachinid fly, dermistid beetle (damage, control measures)

**Dr. V.S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM  
ZOOLOGY SYLLABUS (W.E.F. 2019 – 20)**

**SEMESTER – VI**

**CLUSTER PAPER – VIII\***

**Hrs/week : 4**

**CLUSTER ELECTIVE : VIII-C\* : SERICULTURE**

**VIII-C-1\* : GENERAL SERICULTURE, MULBERRY CULTIVATION &  
MANAGEMENT**

**MODEL PAPER**

**Time : 3 hrs**

**Max. Marks : 60**

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**SECTION – A**

**Answer any FIVE of the following :**

**5 x 8 = 40**

**Draw labeled diagrams wherever necessary**

1. a. Write an essay on types of silk worms and their food plants  
OR  
b. Discuss briefly about the Sericulture industry in different states and its employment ?
2. a. Write an essay on common varieties of mulberry used in india ?  
OR  
b. Write an essay on male and female reproductive organs of mulberry plant ?
3. a. Discuss the physical and chemical properties of soil in mulberry cultivation ?  
OR  
b. Write an essay on the climatic conditions of mulberry cultivation ?
4. a. Write an essay on irrigation in mulberry management ?  
OR  
b. Write an essay on the harvesting techniques of mulberry management ?
5. a. What are the fungal and bacterial diseases in mulberry plants discuss them briefly?  
OR  
b. Write an essay on caterpillars and bugs of mulberry plants?

**SECTION – B**

**Answer any FIVE of the following :**

**5 x 4 = 20**

**Draw labeled diagrams wherever necessary**

6. Definition of sericulture
7. Potential in mulberry culture
8. Anatomy of stem of the mulberry plant
9. Pollination of the mulberry plant
10. Soil moisture
11. Biofertilizers
12. Nematode diseases
13. Beetles

## Cluster Elective Paper: VIII-C-2

### **BIOLOGY OF MULBERRY SILK WORM AND SILKWORM REARING TECHNOLOGY**

CO1: Knowledge about the structure of and reproductive system of silk worm

CO2: Understanding the physiology of silk worm, role of pheromones in mating and of hormones in development

CO3: Application aspects in the development of various silk worm rearing appliances

CO4: Knowledge about various races of silk worms, conditions of rearing and technology of silk worm rearing

CO5: Analysis of various disease causing agents and disease management in silk worm rearing technology

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>                         | <b>Knowledge level (Bloom's Taxonomy)</b>                               | <b>Average level weightage</b> |
|---|---|--------------------------------|
| CO1: Knowledge about the structure of and reproductive system of silk worm                                  | Level 1 (Knowledge)<br>Level 2 (Understanding)                          | <b>1.5</b>                     |
| CO2: Understanding the physiology of silk worm, role of pheromones in mating and of hormones in development | Level 1 (Knowledge)<br>Level 2 (Understanding)                          | <b>1.5</b>                     |
| CO3: Application aspects in the development of various silk worm rearing appliances                         | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2.0</b>                     |
| CO4: Knowledge about various races of silk worms, conditions of rearing and technology of silk worm rearing | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application) | <b>2.0</b>                     |
| CO5: Analysis of various disease causing agents and disease management in silk worm rearing technology      | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 4 (Analysing)   | <b>2.3</b>                     |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 1   | -   | -   | 1   | 2   | 3   | 3   | 3   |
| CO2 | 3   | 1   | -   | -   | 2   | -   | 3   | 3   | 3   |
| CO3 | 3   | -   | -   | -   | 1   | 2   | 3   | 3   | 3   |
| CO4 | 3   | -   | -   | -   | 2   | 2   | 3   | 3   | 3   |
| CO5 | 3   | 1   | -   | -   | 2   | 2   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 1    | 3    | -    | -    | 2    | -    |
| CO2 | 3    | 1    | 3    | -    | -    | 2    | 3    |
| CO3 | 3    | 1    | 3    | 1    | -    | 2    | 3    |
| CO4 | 3    | 1    | 3    | 1    | -    | 2    | 3    |
| CO5 | 3    | 1    | 3    | 1    | -    | 2    | 3    |

**Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A)**  
**ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-C: VI SEMESTER**  
(w.e.f. 2019-20)

**SERICULTURE**

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**Cluster Elective Paper: VIII-C-3**

**SILK TECHNOLOGY, SILK MARKETING AND EXTENSION**

**Periods: 60**

**Max. Marks: 100**

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**Unit - I : Cocoons**

- 1.1 Quality of cocoon, cocoon shell ratio, silk filament length, cocoon reelability and factors effecting reelability
- 1.2 Physical and chemical properties of fibre
- 1.3 Cocoon drying – Conventional and modern techniques
- 1.4 Cocoon sorting and preservation
- 1.5 Cocoon cooking

**Unit - II : Reeling, silk throwing and weaving**

- 2.1 Reeling appliances – Conventional and modern
- 2.2 Reeling operations
- 2.3 Rereeling
- 2.4 Raw silk testing and grading
- 2.5 Silk throwing and twisting
- 2.6 Silk weaving
- 2.7 Chemical processing of silk yarn and fabrics

**Unit - III : Sericulture and management**

- 3.1 Sericulture organisation at state and national levels – Development, research, training and policies
- 3.2 Role of national silk worm seed organisation in grainage
- 3.3 Sericulture services network – Basic seed facility, seed areas, grainages, nurseries, central research centers (CRCs), filature, silk exchanges and cocoon certification centers
- 3.4 Project formulation and role of credit co-operative and financing agencies in sericulture – NAARD, IDBI, Banks, IRDP etc.

**Unit - IV: Marketing organizations, Cocoon and Yarn marketing**

- 4.1 Sericulture marketing organisation for seed cocoon, raw silk and silk fabric
- 4.2 Traditional and regulated markets, their merits and limitations
- 4.3 Government intervention – Legislation and implication in marketing
- 4.4 Marketing institutions – Marketing boards, co-operatives and stabilization of price

**Unit - V : Cocoon and Yarn marketing**

- 5.1 Cocoon marketing – Gradation of seed and reeling cocoons, marketing of multivoltine, bivoltine and hybrid cocoons
- 5.2 Yarn marketing – Gradation of yarn, twisted and untwisted yarn
- 5.3 Feedback system – Surveys and types, merits and limitations
- 5.4 Silk export – Challenges and growth prospects

### **Cluster Elective Paper: VIII-C-3**

#### **SILK TECHNOLOGY, SILK MARKETING AND EXTENSION**

CO1: Knowledge about the properties of cocoon and processing cocoon

CO2: Understanding the applied aspects involved in reeling, silk throwing and weaving technology

CO3: Knowledge and Understanding the policies, research aspects, sericulture network centres and financial agencies involved in sericulture management

CO4: Understanding and analyzing the regulations and legislations related to the market aspects of sericulture

CO5: Analysis and Evaluation of cocoon and yarn marketing India and abroad

| <b>Learning Outcomes: On Completion of the course, the students will be able to</b>  | <b>Knowledge level (Bloom's Taxonomy)</b>   | <b>Average level weightage</b> |
|--|---|--------------------------------|
| CO1: Knowledge about the properties of cocoon and processing cocoon  | Level 1 (Knowledge)<br>Level 2 (Understanding)  | <b>1.5</b>                     |
| CO2: Understanding the applied aspects involved in reeling, silk throwing and weaving technology   | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 3 (Application)                       | <b>2.0</b>                     |
| CO3: Knowledge and Understanding the policies, research aspects, sericulture network centres and financial agencies involved in sericulture management | Level 1 (Knowledge)<br>Level 2 (Understanding)<br>Level 4 (Analysing)                         | <b>2.7</b>                     |
| CO4: Understanding and analyzing the regulations and legislations related to the market aspects of sericulture   | Level 1 (Knowledge )<br>Level 2 (Understanding)   | <b>1.5</b>                     |
| CO5: Analysis and Evaluation of cocoon and yarn marketing India and abroad   | Level 1 (Knowledge )<br>Level 2 (Understanding)<br>Level 4 (Analysis)<br>Level 5 (Evaluation) | <b>3.0</b>                     |

### CO-PO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3   | 2   | -   | -   | 2   | 1   | 3   | 3   | 3   |
| CO2 | 3   | 2   | -   | -   | 2   | 1   | 3   | 3   | 3   |
| CO3 | 3   | 2   | -   | -   | 2   | 1   | 3   | 3   | 3   |
| CO4 | 3   | 2   | -   | -   | 2   | 1   | 3   | 3   | 3   |
| CO5 | 3   | 2   | -   | -   | 2   | 1   | 3   | 3   | 3   |

### CO-PSO Mapping

1-Low, 2-Moderate, 3-High, '-' No Correlation

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | -    | 1    | 1    | 3    | 3    |
| CO2 | 3    | 2    | -    | 1    | 1    | 3    | 3    |
| CO3 | 3    | 2    | -    | 2    | 1    | 3    | 3    |
| CO4 | 3    | 2    | -    | 1    | 1    | 3    | 3    |
| CO5 | 3    | 2    | -    | 1    | 1    | 3    | 3    |