

**ADUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS  
SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU -  
(Autonomous)**

**Accredited by NAAC with "A" Grade**

**2019-20**



**DEPARTMENT OF ZOOLOGY**

**MINUTES OF BOARD OF STUDIES**

**16- 10 -2019 (EVEN SEMESTER)**



2

Minutes of the meeting of Board of studies in Zoology for the Autonomous courses of AG & SG Siddhartha Degree College of Arts & Science, Vuyyuru, held at 10.30 AM on 16-10-2019 in the Department of Zoology.

Smt.D.A. Kiranmayee. ...

Presiding

Members Present:

- 1) S. Aruna Kiranmayee 16/10/19 Chair person Head, Department of Zoology,  
(Smt. D.A.Kiranmayee.) A.G&S.G.S Degree College of  
Vuyyuru-521165.
- 2) J.N. Narayana Latha 16/10/19 University Nominee Dr. J.N.Lavanya Latha,  
(Dr.J.N.Lavanya Latha.) Krishna University,  
Machilipatnam.
- 3) K. Daniel 16/10/19 Academic Council Head, Department of Zoology,  
(Dr. K.Daniel.) Nominee JKC College,  
Guntur,
- 4) B. Elia 16/10/19 Academic Council Head, Department of Zoology,  
(B.Elia.) Nominee Gov. Degree College,  
Pitapuram.
- 5) M. Lakshmi Priyanka 16/10/19 Member Lecturer in Zoology,  
(kum.M.Lakshmi Priyanka.) A.G&S.G.S Degree College  
Vuyyuru-521165.
- 6) B. Appala Naidu 16/10/19 Industrialist Asst. Project Manager,  
(B. Appala Naidu.) RGCA  
Manikonda.
- 7) Ch. Chiranjeevi 16/10/19 Student Represent P.hd –Research Scholar,  
(Ch.Chiranjeevi.) Dept.of Botany & Microbiology,  
Acharya Nagarjuna University,  
Guntur.

Agenda for B.O.S Meeting.

1. To recommend the syllabi (Theory & Practical), Model question paper for II Semester of I B.Sc (B.Z.C) for the academic year 2019-20.
2. To recommend the syllabi (Theory & Practical), Model question paper for IV Semester of II B.Sc (B.Z.C) for the academic year 2019-2020.
3. To recommend the syllabi (Theory & Practical), Model question paper for General Elective -A & Cluster Elective - B to the VI Semester of III B.Sc (B.Z.C) for the academic year 2019-20.
4. To recommend the Blue print for the semester end exam for IV semester of II year. To followed by Blue print for VI semester.
5. To recommend the syllabi (Theory & Practical), Model question paper and Blue print of II semester of I B.Sc for the academic year 2019-20.
6. To recommend a Certificate course on Organic farming to IV semester of II year for the academic year 2019-2020.
7. To recommend the teaching and evolution methods to be followed under Autonomous statues.
8. Any other matter.

B. Arunakishanmayee  
Chairman. 16/10/19



## **RESOLUTIONS**

1. It is resolved to continue the same syllabi (Theory & Practical), model question paper of II semester of I B.Sc. (B.Z.C), under Choice Based Credit System (CBCS) for the academic year 2019 – 20.
2. It is resolved to continue the same syllabi (Theory & Practical), for IV semester of II B.Sc. (B.Z.C) and to be followed the model paper (70:30) for IV semester of II B.Sc.(B.Z.C)
3. It is resolved to continue the same syllabi (Theory & Practical), model papers of under Choice Based Credit System (CBCS) to VI semester General Elective – A (Immunology) and Cluster Elective – B (Principles of Aquaculture, Aquaculture Management, Postharvest Technology.) to the VI semester of III B.Sc (B.Z.C) for the academic year 2019 – 20.
4. It is resolved to follow the Blue prints of II, IV semesters of I,II for the academic year, 2019-20. It is resolved to continue the same Blue print to VI semester of III B.Sc.(B.Z.C).
5. It is resolved to follow the Model question paper and Blue print of II semester of I B.Sc for the academic year 2019-20.
6. It is resolved to implement certificate course for IV semester of II Year.
7. It is resolved to continue the following teaching & evolution methods for the Academic year 2019-20.
8. Any other matter.

### **Teaching methods:**

Besides the conventional methods of teaching, we use modern technology i.e. Using of OHP and LCD projector to display on U boards etc; for better understanding of concepts.

### **Evaluation of a student is done by the following procedure:**

- **Internal Assessment Examination:**
- Out of maximum 100 marks in each paper for II, IV B.Sc , 30 marks shall be allocated for internal assessment.
- Out of these 25 marks , 15 marks are allocated for announced tests (i.e . IA-1& IA-2). Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks are allocated on the basis of candidates percentage of attendance and remaining 5 marks are allocated for the assignment for III B.SC.
- **Semester – End Examination:**
- The maximum mark for I, II B.Sc semester – End examination shall be 70 marks and duration of the examination shall be 3 hours. Even though the candidate is absent for two IA exams/ obtain Zero marks the external marks are considered ( if the candidate gets 40/70) and the result shall be declared as “ PASS ” .
- The maximum marks for III B.Sc semester – End examination shall be 75 marks and duration of the examination shall be 3 hours.
- Semester – End examination shall be conducted in theory papers at the end of every semester, while in practical papers , these examinations are conducted at the end of II, IV, & VI semester for I,II & III B.Sc.

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OF ARTS & SCIENCE (AUTONOMOUS), VUYYURU - 521165, KRISHNS Dt., A.P.

ZOOLOGY

SEMESTER - II w.e.f. - 2018 - 19

Class : I B.Sc

( Code : ZOO -201 C)

No. of Hours per week : 4

Max.Marks: 70

Credits : 3

Title of the Paper : Biology of Chordates

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**UNIT – I**

15hrs.

1.1. Prochordata.

1.1.1. Structure of *Branchiostoma*.

1.1.2. Affinities of Cephalochordata.

1.1.3. Structure and Life History of *Herdmania*.

1.1.4. Significance of Retrogressive metamorphosis.

**UNIT – II**

15hrs.

2.1.Cyclostomata

2.1. Differences between Petromyzonand *Myxine*.

2.2. Pisces.

2.2.1.*Scoliodon*- External features, Digestive System, Respiratory System, Heart, Brain.

2.2.2. Migration in Fishes.

2.2.3. Dipnoi.

**UNIT - III**

10hrs.

3.1.Amphibia

3.1.1. *Rana hexadactyla* - External features, Digestive System, Respiratory System, Heart, Brain.

3.1.2.Parental care in Amphibians

3.2.Reptilia

3.2.1. Calotes - External features, Digestive System, Respiratory System, Heart, Brain.

**UNIT – IV**

12hrs.

4.1.Aves

4.1.1. *Columba livia* - Exoskeleton, Digestive System, Respiratory System, Heart, Brain.

4.1.2.Migration in Birds

4.1.3.Flight adaptations in Birds

**UNIT – V**

8hrs.

5.1.Mammalia

5.1.1. Differences between Prototheria & Metatheria.

5.1.2. Dentition in Mammals.

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**A.G. & S.G.Siddhartha Degree College of Arts & Science, Vuyyuru – 521165,  
Krishna Dt. A.P. (Autonomous)**

**Semester - II**

**(Model question paper)**

**Title of the paper: Biology**

**of – Chordates.**

**Code – Zoo-201C Time: 3hrs.**

**Max. Marks: 70.**

**Section – A 4 x 5= 20.**

Answer any **four** questions. Each question carries **five** marks. Draw neat labeled diagrams wherever necessary.

1. Structure of Branchiostoma.
2. Migration in Fishes.
3. Arterial system in Scoliodon.
4. Parental care in Amphibians.
5. Structure of heart in Calotes.
6. Types of feathers in Birds.
7. Flight adaptations in Birds.
8. Prototheria.

**Section – B 5 x 10 =50.**

Answer any **five** questions. Each question carries **Ten** marks. Draw neat labeled diagrams wherever necessary.

9. What is Retrogressive Meta morphosis? Describe this process in life history of Herdmania?
10. Differentiate between Petromyzon and Myxine?
11. Give an account of Dipnoi fishes.?
12. Describe the structure and working of heart in Rana?
13. Give an account of brain of Calotes?
14. Write an essay on migration in birds?
15. Explain the respiratory system of Columba livia?
16. Write an essay on Dentition in mammals?

**A.G. & S.G. Siddhartha Degree College of Arts & Science, Vuyyuru**  
**Semester - II**

**Zoology**

**Guide lines to the**

**Paper Setter.**

**Title of the paper: Biology of – Chordates. Code – Zoo-201C**

**Time: 3hrs.**

**Max. Marks: 70.**

1. Answer any **five** questions out of eight in Section – A. Each question carries **four** marks. 5x4 = 20M

2. Answer any **five** questions out of eight in Section – B. Each question carries **Ten** marks. 5x10= 50M

	Section	UNIT-I (Prochordata)	UNIT-II (Cyclostomata & Pisces)	UNIT-III (Amphibia & Reptilia)	UNIT-IV (Aves)	UNIT-V (Mammalia)
5 Marks Questions	A	1	2	2	2	1
10 Marks Questions	B	1	2	2	2	1
Weightage		15	30	30	30	15

**Note:** 1. please provide the scheme of valuation for the paper.

2. Question paper should be both in English and Telugu media.

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**A. G.& S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165,  
KRISHNA Dt., A.P. (AUTONOMOUS)**

**ZOOLOGY  
PRACTICAL - II**

**w.e.f. 2018 - 2019**

**I B.Sc**

**Code : ZOO - 201P C**

**Hours / Week: 2**

**Max. Marks: 50**

**Credits: 2**

**External : 25**

**PAPER TITLE: ANIMAL DIVERSITY OF CHORDATES**

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***Observation of the following slides / specimens / models:***

**Protochordata: Salient features of Urochordata & Cephalochordata.**  
Herdmania, Amphioxus, Amphioxus T.S. through pharynx.

**Cyclostomata** : General Characters of Cyclostomes.  
Petromyzon, Myxine.

**Pisces** : General Characters & Classification upto Sub- Class level.  
Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echeneis & Labeo  
**Types of Scales:** Placoid scale, Cycloid scale, Ctenoid scale.

**Amphibia** : General Characters & Classification upto Order level.  
Ichthyophis, Amblystoma, Siren, Hyla, Rachophorus, Axolotl larva.

**Reptilia** : General Characters & Classification upto Order level.  
Draco, Chamaeleon, Uromastix, Russels viper, Naja, Bungarus, Enhydrina & Testudo.

**Aves** : General Characters & Classification upto Sub- Class level.  
Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo.

**Mammalia** : General Characters & Classification upto Sub- Class level.  
Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog.

**Osteology** : Appendicular skeletons of Varanus, Pigeon, Rabbit – Skull, Fore limbs, Hind limbs .

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

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

- Laboratory record work shall be submitted at the time of practical examination.
- Compulsory one species to be adopted for demonstration only by the faculty.

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**A. G. & S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165**  
**EXTERNAL PRACTICAL- II**

(Animal Diversity of vertebrates) (2 hrs/week)  
**MODEL QUESTION PAPER -II** Code: ZOO-201P

**Credits: 2.**

**Time: 3 hrs.**

**Max.marks: 25m.**

- |  |         |
|--|---------|
| 1. Draw neat labeled diagram of IX & X Cranial nerves of Shark.                | 7M      |
| 2. Spotters: Identify, draw labeled diagram & write notes on<br>A, B, C, D & E | 5X3=15M |
| 3. Viva.   | 3M      |
| TOTAL:   | 25M.    |

**Guide lines for the practical Examiners**

**I. List of dissections :** ( 5marks for diagram & 2 marks for labeling)

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

**II. Spotters:** 1Mark for identification, 1 Mark for labeled diagram & 1 Mark for notes for each spotter.

**Chordata: 4 Specimens / Slides / Models**

(Prochordates, Fishes, Amphibians, Reptiles, Birds & Mammals)

**Bone -1.**

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**A. G. & S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165**  
**INTERNAL PRACTICAL- II**

**w.e.f. 2019-2020.**

**(2hrs/week).**

**(Animal Diversity of vertebrates) Code: ZOO-201P.**

**MODEL QUESTION PAPER -II**

**Max.marks: 25M.**

**Time: 3hrs.**

- |                                   |       |      |
|-----------------------------------|-------|------|
| 1. Attendance                     | ----- | 5M.  |
| 2. Record                         | ----- | 10M. |
| 3. Project (Earn while you learn) | ----- | 10M. |

Total ----- 25M.

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**Unit – I (Embryology)**

**1.1 Developmental Biology and Embryology**

1.1.1 Gametogenesis (Spermatogenesis, Oogenesis in mammals)

1.1.2 Fertilization

1.1.3 Types of eggs

1.1.4 Types of cleavages

**1.2 Foetal membranes in Chick**

**1.3 Development - types and functions of Placenta in mammals.**

**2.1 Physiology - I**

2.1.1 Elementary study of digestive process.

2.1.2 Absorption of digested food.

2.1.3 **Respiration** – Structure of mammalian Lung & Mechanism of respiration, transport of oxygen and carbon dioxide

2.1.4 **Circulation** - Structure and functioning of mammalian heart, Cardiac cycle.

2.1.5 **Excretion** - Structure of nephron, urine formation, counter current mechanism.

**Unit – III (Physiology - II)**

**3.1 Physiology - II**

3.1.1 Structure & functional properties of Nerve Cell; Production & propagation of nerve Impulse. Synaptic transmission.

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 Mammals.

**Unit – IV(Ecology – I)**

**4.1Ecology-I**

4.1.1Abiotic factors of Ecosystem – Temperature & Light.

4.1.2 Nutrient cycles - Nitrogen, Carbon and Phosphorus.

4.1.3 Energy flow in ecosystem.

**Unit – V (Ecology – II & Zoogeography)**

**5.1 Ecology - II.**

5.1.1. Community interactions - Mutualism, commensalism, parasitism.

5.1.2. Ecological succession.

**5.2 Zoogeography**5.2.1 5.2.1.Study of physical and faunal peculiarities of Oriental, Australian and Ethiopian regions.

**A.G. & S.G.Siddhartha Degree College of Arts & Science, Vuyyuru**  
**Krishna Dt. A.P. (Autonomous)**

**Semester – IV**

**Time: 3hrs.**

**Max. Marks: 70.**

**Section – A4 x 5 = 20M.**

Answer any **four** questions. Each question carries **Five** marks. Draw neat labeled diagrams wherever necessary.

- 1.Types of eggs.
- 2.Foetal membranes.
- 3.Counter current mechanism.
- 4.Synaptic transmission.
5. Pancreas.
- 6.Energy flow in Ecosystem.
7. Mutualism.
- 8.Parasitism.

**Section – B5 x 10 =50M.**

Answer any **five** questions. Each question carries **Ten** marks. Draw neat labeled diagrams wherever necessary.

- 9.Describe the process of Fertilization.
- 10.Write an essay on placenta.
- 11.Explain the mechanism of transport of oxygen and Carbon –dioxide in blood of mammals.
- 12.Describe the structure and working of mammalian heart.
- 13.Explain the structure and functions of pituitary gland.
- 14.Describe the Carbon and Nitrogen cycle.
- 15.Describe the process of Ecological succession in a pond.
- 16.Give an account of the fauna of oriental region.

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**A.G. & S.G. Siddhartha Degree College of Arts & Science, Vuyyuru**  
**Krishna Dt. A.P. (Autonomous)**

**Semester - IV**

**Zoology**

**Guide lines to the Paper Setter.**

**Title of the paper: Embryology,**

**Physiology and Ecology.**

**Code – Zoo-401C**

**Time: 3hrs.**

1. Answer any **four** questions out of eight in Section .A. Each question carries five marks.  
4x5=20m.

2. Answer any **five** questions out of eight in Section – B. Each question carries **Ten** marks. 5x10=50M.

	PART	UNIT-I  Embryology	UNIT-II  Physiology-I	UNIT-III  (Physiology -II )	UNIT-IV  Ecology-I	UNIT-V  (EcologyII, Zoogeogra phy)
5 Marks Questions	A	2	1	2	1	2
10 Marks Questions	B	2	2	1	1	2
Weightage		30	25	20	15	30

**Note:** 1. please provide the scheme of valuation for the paper.

2. Question paper should be both in English and Telugu media.

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A.G& S.G.S.DEGREE COLLEGE OF ARTS & SCIENCE,VUYYURU - 521165,  
KRISHNA Dt., A.P. (AUTONOMOUS)

ZOOLOGY PRACTICAL SYLLABUS  
SEMESTER - IV

PAPER – IV

w.e.f : 2019 - 20

Periods: 24Max. Marks: 50

Paper Title: Embryology,Physiology & Ecology    Paper Code : 401P

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**I. Embryology**

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

**II. Physiology**

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

**III. Ecology**

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

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**A. G & S. G. S. DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU 521165, KRISHNA Dt., A.P.**  
**(AUTONOMOUS)**  
**PAPER – IV**

(Embryology, Physiology & Ecology)

Model question paper ( External)w.e.f.2019-20.

Max.Marks: 25 M.

Paper Code: ZOO-401C

**I.Embryology:**

1. Identify, draw neat labeled diagram & comment on .  $1\frac{1}{2} \times 2 = 3M.$  **A & B**

**II. Physiology**

2. Identify, draw neat labeled diagram & comment on .  $1\frac{1}{2} \times 2 = 3M.$  **A & B**
3. Identify the organic substances in the given samples A & B, each with two tests.  $4 \times 1\frac{1}{2} = 6M.$   
(Sample A-  $2 \times 2\frac{1}{2} = 5$  Marks & sample B --  $2 \times 2\frac{1}{2} = 5$  Marks)
4. Identify the Excretory products in the given samples A & B, each with two tests.  $4 \times 1\frac{1}{2} = 6M.$   
(Sample A-  $2 \times 2\frac{1}{2} = 5$  Marks & sample B --  $2 \times 2\frac{1}{2} = 5$  Marks)

**III. Ecology:**

5. Determine the  $P^H$  of given sample.  $1 \times 2 = 2M.$
6. Estimate the dissolved oxygen in the given sample.  $1 \times 5 = 5M.$

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A. G.& S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165  
ZOOLOGY PRACTICAL -IV  
(INTERNAL)  
(Embryology,Physiology &Ecology) w .e.f. 2019-2020.

(2hrs/week).

Code: ZOO-401P.

Max.marks:25M

Time: 3hrs.

- |               |       |      |
|---------------|-------|------|
| 1. Attendance | ----- | 5M.  |
| 2. Record     | ----- | 10M. |
| 3. Assignment | ----- | 10M. |

Total ----- 25M.

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SEMESTER - VI

ZOOLOGY –ELECTIVE PAPER: VII-(A)

Class IIIB.Sc

w.e.f.- 2017- 18

Paper Code : ZOO -601C

60 Hrs.

Paper code: Zoo-601GEEExternal: 75

25

Immunology.

Objective of the course: To facilitate students to understand the role of immune system in the body, cells and organs of immune system, their structures and functioning.

Course outcomes:

- ❖ Students grow in understanding of immune system, to improve their immunity and to protect them from pathogens.
- ❖ They identify their blood groups, their compatibility and the need to donate blood to save life.
- ❖ Students identify the classes, structures and functions of antibodies, antigen –antibody reactions.
- ❖ This study enables students to take care of themselves and take timely precautions against various disease.
- ❖ They identify the cure of different diseases through various vaccines, the instruments involved in identification of immune reactions etc.

**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 an antibody

3.1.2 Classes and functions of antibodies

3.1.3 Antigen and antibody interactions.

3.1.4 Monoclonal antibodies and their production.

**Unit - IV**

**4.1 Working of an 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 mediator molecules. (cytokines, interferons and complement proteins).

4.1.4 Mechanisms of humoral and cell mediated immunities

**Unit - IV**

**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

**KRISHNA Dt.,A.P. (AUTONOMOUS)**  
**SEMESTER-VI (Model Question paper)**

**Paper Title: Immunology**

**Paper Code:ZOO-601GE**

**SECTION-A**

Answer **any five** questions out of eight in Part - A. Each question carries five marks. **5 X 5 =**

- 1.** Active immunity
- 2.** Monoclonal antibodies.
- 3.** TCell Epitope
- 4.** Structure of antibody.
- 5.** Functions of major histocompatibility complexes(MHC)
- 6.** Humoral immunity.
- 7.** Causes of autoimmune diseases.
- 8.** BCG Vaccine .

**Part – B**

Answer **any five** questions out of eight in Part – B. Each question carries ten marks. **5 X 10 = 50**

- 9.** Give an account of innate immunity.
- 10.** Write an essay on primary lymphoid organs.
- 11.** Discuss about the basic properties of Antigen.
- 12.** Write an essay on immunogenicity.
- 13.** Describe about different types of immunoglobulins.
- 14.** Give an account of basic properties and functions of Cytokines.
- 15.** Define Hypersensitivity . Explain it in detail.
- 16.** Explain different types of vaccines.

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ZOOLOGY PRACTICAL SYLLABUS

Period: 24

PAPERS – VI

Max.Marks:50

Credits: 2

Paper Code: ZOO-601GE (P)

Paper Title: Immunology.

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

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**REFERENCES BOOKS**

William F. Ganong, A Review of Medical Physiology, 22 ed, McGraw Hill, 2005

Sherwood, Klandrof, Yanc, Human Physiology, Thompson Brooks/Coole, 2005.

Knut Schmidt-Nielson, Animal Physiology, 5th ed, Cambridge Low Price Edition.

Richard A. Glodsby, Thomas J Kind, Barbara A. Osborne, Janis Kuby, Immunology, 5th ed,  
Freeman and Co. New York

Ivan Roitt, Immunology, 4th ed, JohanthanBrostoff, Moshy, London.

Thomas C. Chung, General Parasitology, Hardcourt Brace and Co ltd. Asia. New Delhi.

Gerard D. Schmidt and Larry S Roberts, Foundations of Parasitology, McGraw Hill

Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006). VI Edition. Immunology. W.H.  
Freeman and Company.

Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006). XI Edition. Roitt's Essential  
Immunology, Blackwell Publishing.

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**SEMESTER-VI**  
**Time: 3 hrs**                      **ZOOLOGY ELECTIVE PAPER-VII (A)**

**Max.Marks:75**

**Guide lines to the paper setter**  
**Paper Title:Immunology.**                      **Paper Code: ZOO-601GE**

*Note:*1. Answer **any five** questions out of eight in Part-A. Each question carries five marks.5 X 5= 25M.

2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks5 X 10= 50M.

	<b>PART</b>	<b>Unit – I</b>	<b>Unit – II</b>	<b>Unit – III</b>	<b>Unit – IV</b>	<b>Unit – V</b>
<b>5 Marks Questions</b>	<b>A</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>10 Marks Questions</b>	<b>B</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>Weightage</b>		<b>25</b>	<b>25</b>	<b>20</b>	<b>20</b>	<b>30</b>

- Note:**
1. please provide the scheme of valuation for the paper.
  2. Question paper should be both in English and Telugu media.

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**A.G& S. G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU - 521165,  
KRISHNA Dt., A.P. (AUTONOMOUS)**

**(Immunology)**

**Max.marks:25m**

Model Question Paper (External) Paper Code: ZOO-601GE (P)  
Practical - V

1. Demonstration of lymphoid organs (as per UGC guidelines) 5m
  2. Blood group determination 5m
  3. Study the following techniques given on photographs & Write notes on. 2x5=10m  
A & B
  4. ELISA & Immunoelectrophoresis (demonstration) on site or of site demonstration. 5m
- Total: 25m.

**Guide lines for the Practical Examiners.**

1. Demonstration of lymphoid organs  
(5 marks for Procedure)
2. Blood group determination.  
(5 marks for Procedure)
3. Study the following techniques given on photographs & Write notes on A & B.  
(1 mark for identification & 4 marks for diagram and notes, for each photographs)
4. ELISA (demonstration) on site or of site demonstration.  
( 5 marks for ELISA demonstration)

**A.G & S. G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU - 521165,  
KRISHNA Dt., A.P. (AUTONOMOUS)**

**(Immunology) Max. Marks: 25**

**Model Question Paper (Internal)**

**Paper Code: ZOO-601GE (P)**

**Practical - V**

1. Attendance	--	5 M
2. Record	--	10M
3. Assignments	--	10M
Total	--	25M

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**ADUSUMILLI GOPALAKRISHNAIAH & SUGARCANE GROWERS SIDDHARTHA  
DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU- 521165, KRISHNA Dt., A.P.  
(AUTONOMOUS)**

**SEMESTER - VI (CBCS)**

Class: III B.Sc (B.Z.C)

(Cluster Elective Paper: VIII-B-1)

**w.e.f. –2017-18**

60 Hrs( 4hrs/ week)

Paper Code : ZOO-602CE

Credits : 3

External : 75

Title of the Paper: Principles of Aquaculture.

Internal: 25

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**Objective of the course:** To introduce students into aquaculture practices

**Course outcomes:**

- ❖ Students get wider knowledge on aquaculture
- ❖ The study of students Types of Aquaculture ,culture systems and Culture Practices
- ❖ They learn about design and construction of aqua farms( pond formation)
- ❖ They study various economically important species
- ❖ Students get acquainted with sea weed and their benefits.

**UNIT –I**

- 1.1 Introduction / Basics of Aquaculture: - Definition, Significance and History of Aquaculture
- 1.2 Present status of Aquaculture – Global and National scenario
- 1.3 Major cultivable species for aquaculture: freshwater, brackish water and marine.
- 1.4 Criteria for the selection of species for culture

**Unit – II**

**2.1 Types of Aquaculture:-** Freshwater, Brackishwater and Marine

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

**2.2 Culture systems :-** Ponds, Raceways, Cages, Pens, Rafts and water recirculating systems

**2.3 Culture practices :-** Traditional, extensive, modified extensive, semi-intensive and intensive cultures of Fish and shrimp.

**Unit – III**

**3.1 Design and construction of aqua farms :-** Criteria for the selection of site for freshwater and brackish water pond farms, Design and construction of fish and shrimp farms

**3.2 Seed resources :-** Natural seed resources and Procurement of seed for stocking: Carp and shrimp

**3.3 Nutrition and feeds :-** Nutritional requirements of a cultivable fish and shellfish

3.4 Natural food and Artificial feeds and their importance in fish and shrimp culture

**Unit – IV**

**4.1 Management of carp culture ponds:-** Culture of Indian major carps: Pre-stocking management – Dewatering, drying, 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



SEMESTER-VI (Model Question paper)  
Cluster Electives paper –VIII-B-1

Time: 3 hrs

Max.Marks:75

*Paper Title: Principles of Aquaculture.*

*Paper Code: ZOO-602CE*

**Part - A**

Answer **any five** questions out of eight in Part - A. Each question carries five marks. **5 X 5 = 25**

- 1.Aquaculture History
- 2.NationalStatus of Aquaculture.
- 3.Monoculture.
- 4.Cage culture
- 5.Criteria for selection of site for fresh water culture.
- 6.Seed resources of carp fish.
7. Pre- Stocking Management of carps.
8. Byproducts of sea weeds.

**Part – B**

Answer **any five** questions out of eight in Part – B. Each question carries Ten marks. **5 X 10 = 50**

- 9.Describe any three cultivable species of fresh water ponds.
- 10.Write the criteria for the selection of species for culture.
- 11.Write an essay on water recirculated system.
- 12.Write an essay on types of Aquaculture which you have studied.
- 13.Give an account of design and construction of Aquaculture.
- 14.Explain natural and artificial feeds and their importance in fish feeding.
- 15.Give an account of post- stock Management of carps.
- 16.Give an account of culture of penaeus monodon.

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**ADUSUMILLI GOPALAKRISHNAIAH & SUGARCANE GROWERS SIDDHARTHA  
DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU- 521165, KRISHNA Dt., A.P.  
(AUTONOMOUS)**

**SEMESTER-VI  
Cluster Electives paper –VIII-B-1**

**Guide lines to the paper setter**Time: 3 hrs  
Max.Marks:75

**Paper Title:**

Principles of Aquaculture.

**Paper Code: ZOO-602CE**

*Note:* 1. Answer **any five** questions out of eight in Part-A. Each question carries five marks. 5 X 5 = 25M.

2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks. 5 X 10 = 50M.

	<b>PART</b>	<b>Unit – I</b>	<b>Unit – II</b>	<b>Unit – III</b>	<b>Unit – IV</b>	<b>Unit – V</b>
<b>5 Marks Questions</b>	<b>A</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>10Marks Questions</b>	<b>B</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>Weightage</b>		<b>30</b>	<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>

- Note:**
1. please provide the scheme of valuation for the paper.
  2. Question paper should be both in English and Telugu media.

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**SEMESTER - VI (CBCS)**

**w.e.f. - 2017 - 18**

Class: III B.Sc (B.Z.C)

(Cluster Elective Paper: VIII-B-2)

60 Hrs. (4hrs/Week)

Paper Code : ZOO-603CE

Credits : 3

External : 75

**Title of the Paper: Aquaculture**

**Management.**

**Objectives of the course:** To instruct students on aquaculture managerial skills.

**Course out comes:**

- ❖ Students get know about breeding technology of fishes, Hatching and hatching methodology.
- ❖ Students learn to analyse the quality of water and soil.
- ❖ They are trained on feed storage, Feeding strategies: Feeding devices, feeding schedules and ration size.
- ❖ They gain knowledge on diseases of fish and shrimp and the strategies involved in marketing.
- ❖ They study economics and Marketing , **Fisheries Extension and** important of fish genetics.

**Unit – I**

**1.1 Breeding and Hatchery Management:-** Bundh Breeding and Induced breeding of carp by Hypophysation;  
and Use of synthetic hormones.

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

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

1.4 Breeding and Hatchery management of giant freshwater prawn.

**Unit – II**

**2.1 Water quality Management:-** Water quality and soil characteristics suitable for fish and shrimp culture

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

2.3 Liming materials, Organic manures and Inorganic fertilizers commonly used and Their implications in fish ponds

**Unit – III**

**3.1 Feed Management :-** Live Foods and their role in shrimp larval nutrition.

3.2 Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed additives and Preservatives;

role of probiotics. Feed formulation and manufacturing; Feed storage

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

**Unit – IV**

**4.1 Disease Management :-** Principles of disease diagnosis and health management;

4.2 Prophylaxis, Hygiene and Therapy of fish diseases

4.3 Specific and non-specific defense systems in fish; Fish immunization and Vaccination

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

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

**Unit – V**

**5.1 Economics and Marketing :-** Principles of aquaculture economics – variable costs, cost-benefit analysis, Fish marketing methods in India; Basic concepts in demand and price analysis.

**5.2 Fisheries Extension :** Fisheries Training and Education in India; Role of extension in community development.

**5.3 Fish Genetics** Genetic improvement of fish stocks – Hybridization of fish.

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

SEMESTER-VI (Model Question paper)  
Cluster Electives paper –VIII-B-2

Time: 3 hrs

Max.Marks:75

Paper Title: Aquaculture Management. Paper Code: ZOO-603CE

**Part - A**

1. Answer **any five** questions out of eight in Part - A. Each question carries five marks. **5 X 5 = 25**

- 1.Bundh Breeding.
- 2.Types of hatcheries.
- 3.Liming Material.
- 4.Organic Manures.
- 5.Feed evaluation.
- 6.Supplementary feeds.
- 7.Sympptoms of fish diseases
- 8.Gynogenesis.

**Part – B**

2.Answer **any five** questions out of eight in Part – B. Each question carries ten marks. **5 X 10 = 50**

- 9.Describe the induced breeding of carps by Hypophystion
- 10.Give an account of breeding and Hatchery management of panaeus monodon
- 11.Describe the water quality characteristics of fish ponds.
- 12.Describe the identification of oxygen depletion problems and control mechanisms in culture ponds.
- 13.Give an account of Feed formulation and manufacturing.
- 14.Write an essay on feeding strategies.
- 15.Describe symptoms therapy and prophylaxis of any three diseases related to prawn.
- 16.Write an essay on Transgenic fish.

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**SEMESTER-VI**  
**Cluster Electives paper –VIII-B-2**

**Guide lines to the paper setter**Time: 3 hrs  
Max.Marks:75

**Paper**

**Title:**Aquaculture Management **Paper Code: ZOO-603CE**

*Note:*1. Answer **any five** questions out of eight in Part-A. Each question carries five marks. 5 X 5 = 25M.

2. Answer  
any **five** questions out of eight in Part-B. Each question carries 10 marks.5 X 10 = 50M.

	<b>PART</b>	<b>Unit – I</b>	<b>Unit – II</b>	<b>Unit – III</b>	<b>Unit – IV</b>	<b>Unit – V</b>
<b>5 Marks Questions</b>	<b>A</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>10 Marks Questions</b>	<b>B</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>Weightage</b>		<b>30</b>	<b>25</b>	<b>30</b>	<b>15</b>	<b>20</b>

- Note:**
1. Please provide the scheme of valuation for the paper.
  2. Question paper should be both in English and Telugu media.

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**SEMESTER - VI (CBCS)**

Class: III B.Sc (B.Z.C)

(Cluster Elective Paper: VIII-B-3)

**w.e.f. - 2017 - 1860**

Hrs (4hrs/Week)

Paper Code: ZOO-604CE

Credits: 3

External: 75

Internal: 25 **Title**

**of the Paper: Postharvest Technology.**

**Objective of the course:** To prepare students to become future aqua culturists.

**Course out comes:**

- ❖ Students are given techniques to handle fresh fish, storage, preservation and transport.
- ❖ They learn to extract maximum from fish and produce fish products.
- ❖ They can earn while they learn.
- ❖ They are taught rules and regulations pertaining to quality control.
- ❖ Students get know about Quality Assurance, Management and Certification

**Unit – I**

**1.1 Handling and Principles of fish Preservation :-** Handling of fresh fish, storage and transport of fresh fish,

post mortem changes (Rigor mortis and spoilage), spoilage in marine fish and freshwater fish.

**1.2 Principles of preservation–** cleaning, lowering of temperature, rising of temperature, use of salt, use of fish preservatives, exposure to low radiation.

**Unit – II**

**2.1 Methods of fish Preservation :-** 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 :-** 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, petfood from trash fish, fish manure.

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

**3.3 Seaweed Products :-** Preparation of agar, algin and carrageen. Use of seaweeds as food for human consumption.

**Unit – IV**

**4.1 Sanitation and Quality control :-** Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.

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

4.3 Regulatory affairs in industries

**Unit – V**

**5.1 Quality Assurance, Management and Certification :-** 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.

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



SEMESTER-VI (Model Question paper)

**Cluster Electives paper –VIII-B-3**

**Time: 3 hrs Max.Marks:75**

**Paper Title: Postharvest Technology.**

**Paper Code: ZOO-604CE**

**Part - A**

Answer **any five** questions out of eight in Part - A. Each question carries five marks. **5 X 5 = 25**

1. Storage of fish.
2. Exposure of fish to low radiation of gamma rays.
3. Accelerated freeze drying.
4. Pickling of fish
5. Fish oils.
6. Fish meal.
7. Pre- processing control of fishery products.
8. Codex Alimentarius.

**Part – B**

Answer **any five** questions out of eight in Part – B. Each question carries ten marks. **5 X 10 = 50**

9. Write the principles of fish preservation.
10. Write about spoilage in marine fish and fresh water fish.
11. Write about the Traditional methods of fish preservation like sun drying ,salt curing and smoking .
12. Give an account of advanced methods of preservation like chilling, freezing & canning.
13. Write an essay on any five fish byproducts.
14. Explain how sea weeds are useful in disease treatment and preparation of therapeutic drug.
15. Write an essay on environmental hygiene in processing plants.
16. Explain about the concept of hazard analysis & critical control points in sea food safety.

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**A.G& S.G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU 521165, KRISHNA Dt., A.P.  
(AUTONOMOUS)**

**SEMESTER-VI  
Cluster Electives paper –VIII-B-3**

**Guide lines to the paper setter**Time: 3 hrs  
Max.Marks:75

**Paper Title:**Postharvest Technology.**Paper Code: ZOO-604CE**

*Note:*1. Answer **any five** questions out of eight in Part-A. Each question carries five marks.5 X 5 = 25M.

2. Answer any **five** questions out of eight in Part-B. Each question carries 10 marks.5 X 10 = 50M.

	<b>PART</b>	<b>Unit –I</b>	<b>Unit – II</b>	<b>Unit-III</b>	<b>Unit – IV</b>	<b>Unit – V</b>
<b>5 Marks Questions</b>	<b>A</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>10 Marks Questions</b>	<b>B</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>Weightage</b>		<b>30</b>	<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>

- Note:**
1. please provide the scheme of valuation for the paper.
  2. Question paper should be both in English and Telugu media.

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Credits:2	<b>ZOOLOGY PRACTICAL</b>	:	<b>24</b>
	<b>Periods</b>		

**Max.Marks:50** **Paper Title : Aquaculture (*Principles of Aquaculture*)**

**Code : ZOO-C-I**

## Cultivable fishes

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

## Diseases

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

## Pond Management

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

A.G & S. G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU - 521165, KRISHNA Dt.,  
A.P. (AUTONOMOUS)

### Practical - VI

*w.e.f. 2019-20.*

**(Principles of Aquaculture) Max. Marks: 25**

**Model Question Paper (External)**

**Paper Code: ZOO-C-I**

***I. Cultivable fishes:***

1. Spotters: Identify, draw neat labeled diagram and comment on A, B, C & D 4X2=8m

## ***II. Diseases:***

- |  |        |
|--|--------|
| 2. Identification and study of fish and shrimp diseases- Using specimens/ Pictures A & B | 2x2=4m |
| 3. External examination of the diseased fish –diagnostic features and procedure.         | 3m     |
| 4. Determination of dosages of chemicals and drugs for treating common diseases          | 1x3=3m |

### ***III:Pond management:***

5. Identification and study of common zooplankton, aquatic insects and aquatic weeds. 2x2=4m  
A & B
6. Salinity in the pond water sample. 3m

**Total** -- 25

**Guide lines for the Practical Examiners.      w.e.f. 2019–20.**

1. Spotters: Identify and comment on A, B, C & D (Charts / Photographs). 4X2=8m  
(Identification -  $\frac{1}{2}$  mark, neat labeled diagram and Comments -  $1\frac{1}{2}$  m)
2. Identify and comment on A & B (Charts / Photographs) 2x2=4m  
(Identification -  $\frac{1}{2}$  mark & Comments -  $1\frac{1}{2}$  m)
3. External examination of the diseased fish –diagnostic features and procedure. 3m  
( 3 marks for Procedure)
4. Determination of dosages of chemicals and drugs for treating common diseases 1x3= 3m
5. Identification and study of common zooplankton, aquatic insects and aquatic weeds. 2x2=4m  
(Identification -  $\frac{1}{2}$  mark & Comments -  $1\frac{1}{2}$  m)
6. Salinity in the pond water sample. 3m

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***Practical - VI w.e.f. 2019–20.***

***(Principles of Aquaculture)***

***Max. Marks: 25***

***Model Question Paper (Internal)***

***Code: ZOO-C-I***

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1. Attendance	--	5 M
2. Record	--	10M
3. Assignments	--	10M
Total	--	25M

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ZOOLOGY PRACTICAL

Credits:2      Periods : 24

Max.Marks:50

Paper Title : Aquaculture (*Aquaculture management*)

Code : ZOO-C-II

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**Nutrition**

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

**Post harvest Technology**

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

A.G & S. G.S.DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU - 521165, KRISHNA Dt.,  
A.P. (AUTONOMOUS)

*Practical - VI*

(*Aquaculture management*)  
*Model Question Paper (External)*

*w.e.f. 2019 - 20*  
*Max. Marks: 25*  
*Paper Code: ZOO-C-II*

**I. Nutrition:**

1. Identification and study of Live food organisms- A & B 2X2=4m
2. Estimation of Proximate composition of aquaculture feeds – A & B 2x2<sup>1/2</sup>=5m

**II. Post harvest Technology:**

3. Curd and fermented fish products (Procedure) 5m
  4. Preparation of isinglass, collagen and chitosan from shrimp and crab shell. 5m
  5. Identification of hazards & Comment on A & B. 2x3=6m
- Total-----25m

**Guide lines for the Practical Examiners.**

***w.e.f. 2019 - 20***

***Max. Marks: 25***

1. Identify and comment on A & B (Charts / Photographs).  
(Identification -  $\frac{1}{2}$  mark and Comments -  $1\frac{1}{2}$  m)

2. Estimation of Proximate composition of aquaculture feeds – A & B  
(Composition – A- $2\frac{1}{2}$  Composition – B- $2\frac{1}{2}$  )

3. Curd and fermented fish products (Procedure)  
(5 marks for Procedure)

4. Preparation of isinglass, collagen and chitosan from shrimp and crab shell.  
(If any one Procedure – 5 marks)

5. Identification of hazards & Comment on A & B  
(Identification - 1 mark & Comments- 2m)

***Practical - VI w.e.f. 2019–20.***

***(Aquaculture management)***

***Max. Marks: 25***

***Model Question Paper (Internal) Code: ZOO-C-II***

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1. Attendance	--	5 M
2. Record	--	10M
3. Assignments	--	10M
Total	--	25M

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**ZOOLOGY PRACTICAL**

Credits:2      Periods : 24

**Max.Marks:50**

**Paper Title : Aquaculture (*Post-harvest Technology*)      Code : ZOO-C-III (PROJECT)**

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**Project Work**

Visit to a fish breeding centre / fish farms and submit a project report

Or

Visit to a feed manufacturing unit and submit a project report

Or

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

Or

Visit to a shrimp processing unit and submit a project report

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A.P. (AUTONOMOUS)

***Practical - VI                      w.e.f. 2019–20.***

***(Post-harvest Technology)              Max. Marks: 25***

***Model Question Paper (Internal)                      Code: ZOO-C-III (PROJECT)***

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1. Attendance	--	5 M
2. Project Record – (Fish form)	--	10M
3. Project Record – (Fish form)	--	10M
<b>Total</b>	<b>--</b>	<b>25M</b>

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