

**SRR & CVR GOVERNMENT DEGREE COLLEGE (AUTONOMOUS)**

**VIJAYAWADA**



ज्ञान-विज्ञान विमुक्तये

**UGC**

**University Grants Commission**



**Resolutions**

**for**

**B. Voc Aquaculture Technology**

**SEMESTER- V and VI**

**SYLLABUS AND MODEL QUESTION PAPERS**

**(AS PER CBCS AND SEMESTER SYSTEM)**

**(W.E.F.2022-23)**

**Minutes of the meeting of the Monitoring Committee in the Subject of B.Voc  
Aquaculture Technology**

The monitoring Committee for B.Voc Courses constituted vide the Proceedings of The Principal, SRR & CVR Government Degree College (A) Vijayawada, dated-15-11-2021, Rc. No. SRR-UG – Com/2M/BoS –2020-21, met online on ZOOM Platform with the link <https://meet.google.com/cgw-vndc-baw> on 2-8-2022 for the ratification of **B.Voc Aquaculture Technology** course syllabus of the subjects that are already approved in their respective departmental BoS for Semester V & VI **AY 2022-23** under the chairmanship of Dr C. Bramhaiah, Lecturer in Commerce, B. Voc Course Coordinator.

**The following monitoring Committee members attended the meeting online:**

- 1. Dr C.Bramhaiah** (Chairman)  
Lecturer in Commerce  
SRR & CVR GDC(A)  
Vijayawada
- 2. Dr. D Ramasekhar Reddy** (University Nominee)  
Controller of Examinations  
Krishna University  
Machilipatnam
- 3. Dr.M.Vijaya Kumar** (Incharge of the Department)  
Head and Incharge  
Department of Zoology  
SRR & CVR GDC (A),  
Vijayawada
- 4. Smt N.Suneetha** ( Faculty member)  
Lecturer in Zoology  
SRR & CVR GDC (A),  
Vijayawada
- 5. Dr.G.Vani** (Subject Expert)  
Lecturer in Zoology  
DRG GDC  
Tadepalligudem
- 6. Sri. B. Appala Naidu** (Industrial Expert)  
Principal Scientific Officer  
Tilapia Fish Project  
Rajiv Gandhi Centre for Aquaculture (RGCA)  
Manikonda

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The monitoring Committee for B.Voc Courses constituted vide the Proceedings of The Principal, SRR & CVR Government Degree College (A) Vijayawada, dated-15-11-2021, Rc. No. SRR-UG – Com/2M/BoS –2020-21, met online on ZOOM Platform with the link <https://meet.google.com/cgw-vndc-baw> on 2-8-2022 for the ratification of **B.Voc Aquaculture Technology course** syllabus of the subjects that are already approved in their respective departmental BoS for Semester V & VI AY 2022-23 under the chairmanship of Dr C. Bramhaiah, Lecturer in Commerce, B. Voc Course Coordinator.

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**1. Dr C.Bramhaiah**

Lecturer in Commerce  
SRR & CVR GDC(A)  
Vijayawada

(Chairman)



**2. Dr. D Ramasekhar Reddy**

Controller of Examinations  
Krishna University  
Machilipatnam

(University Nominee)

*Attended online*

**3. Dr.M.Vijaya Kumar**

Head and Incharge  
Department of Zoology  
SRR & CVR GDC (A),  
Vijayawada

(Incharge of the Department)



**4. Smt N.Suneetha**

Lecturer in Zoology  
SRR & CVR GDC (A),  
Vijayawada

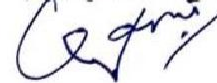
( Faculty member)



**5. Dr.G.Vani**

Lecturer in Zoology  
DRG GDC  
Tadepalligudem


(Subject Expert)



**6. Sri. B. Appala Naidu**

Principal Scientific Officer  
Tilapia Fish Project  
Rajiv Gandhi Centre for Aquaculture (RGCA)  
Manikonda

(Industrial Expert)



## AGENDA

- To ratify the syllabus of various subjects that are approved in their respective BOS meetings for B. Voc Aquaculture Technology course.
- To ratify the Blue print of various subjects that are approved in their respective BOS meetings for B. Voc Aquaculture Technology course.
- To ratify the Question papers of various subjects that are approved in their respective BOS meetings for B. Voc Aquaculture Technology course.
- To approve the credits for various subjects in B. Voc Aquaculture Technology course.
- To approve the evaluation pattern for B. Voc Aquaculture Technology course.

## Resolutions:

- Resolved to approve the syllabus of subjects - **General Components** - Zoology and Chemistry; **Skill components** -Aquaculture paper XIII, XIV, XV, that were approved in their respective BoS meetings for B. Voc Aquaculture Technology course.
- Resolved to ratify the Blue print of various subjects that are approved in their respective BOS meetings for B. Voc Aquaculture Technology course.
- Resolved to approve the Model Question papers of various subjects that are approved in their respective BOS meetings for B. Voc Aquaculture Technology course.
- Resolved to approve the credits of various subjects in B. Voc Aquaculture Technology course.
- Resolved to approve the evaluation pattern for B. Voc Aquaculture Technology course.
- Resolved to approve the division of 100 marks into two components as Internal and External for General components – Zoology and Chemistry; Skill components - Aquaculture Paper.
- Resolved to approve the division of marks for (Internal) CIA as 40 marks and (External) SEE as 60 marks with the suggested blue print and model paper.
- External 60 Marks: Section-A consisting 20 Marks, Short Answer questions (Any 5 from given 10), Section-B consisting 40 Marks , Essay Questions (Any 5 with internal choice from given 10)
- Internal 40 Marks. To evaluate Internal Assessment as follows:- Average of two Internal exams of 10 marks -10 marks, Assignments (two) -10 marks, Project -10 marks, Seminar- 05 marks, Attendance-05 marks .
- The pass mark is 40% i.e., 24 out of 60 for External and 16 out of 40 for Internal.
- Resolved to approve and divide the 50 marks into two components for Practicals, External 25 Marks and Internal 25 marks
- The minimum pass mark is 40% i.e., 10 out of 25 for External and Internal each

## **PROGRAMME: THREE-YEAR**

### **B. Voc Aquaculture Technology**

The syllabus for B. Voc. Aquaculture Technology is framed at undergraduate level using the Choice Based Credit system. The main objective of framing this syllabus is to give the students a holistic understanding of the subject giving substantial weightage to the Skill Components and General component useful for Aquaculture. The syllabus has also been framed in such a way that the basic skills of subject are taught to the students and may continue higher studies in post graduation and/or secure a job after graduation.

#### **PROGRAMME OUTCOMES:**

On completion of their degree, students will develop a comprehensive and well-founded knowledge in aquaculture. Graduates of the course are expected to be able to:

1. Demonstrate a sound understanding of the Analytical Chemistry, Animal biotechnology and Immunology, fish processing technology, quality control in processing plants and microbiology of aquaculture organisms.
2. Employ knowledge of health and safety issues in aquaculture ventures
3. Employ scientific techniques, practical skills and business management strategies to improve aquatic resource management
4. Understand and interpret critical, scientific and ethical issues in aquaculture
5. Suggest measures to prevent diseases in aquaculture
6. Maintain the standard quality control protocols laid down in aqua industry
7. Demonstrate research skills appropriate for further study and employment
8. Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.
9. Get familiar with the tools and techniques of animal biotechnology, Immunology, quality control, fish processing and fishery microbiology.

## LEARNING OUTCOMES

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods
6. To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
7. To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
8. To provide knowledge on animal cell and tissue culture and their preservation
9. To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
10. To explain in vitro fertilization, embryo transfer technology and other reproduction manipulation methodologies.
11. To trace the history and development of immunology
12. To provide students with a foundation in immunological processes
13. Examine the diseases of fin and shell fish
14. Identify the types of preservation methods employed in aquaculture
15. Choose the suitable Processing methods in aquaculture
16. Identify the best Seafood quality assurance system
17. Identify the quality of aqua processed products.
18. Determine the quality of fishery by products by observation
19. Analyze the protocols of aqua processing methods

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**

**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**II B. Voc Aquaculture Technology Syllabus and Title of Paper**

<b>SEMESTER – V</b>						
<b>GENERAL COMPONENTS</b>						
No	Title	Credits	Hours/week	Internal Marks	External Marks	Total
1	Chemistry –Paper 6 – Theory	3	3	40	60	100
	Chemistry –Paper 6 - Practical	1	2	25	25	50
2	Zoology –Paper 5 – Theory	3	3	40	60	100
	Zoology –Paper 5 – Practical AB	1	2	25	25	50
3	Zoology –Paper 6 – Theory IM	3	3	40	60	100
	Zoology –Paper 6 - Practical -2	1	2	25	25	50
	<b>Total</b>	<b>12</b>	<b>15</b>			
<b>SKILL COMPONENTS</b>						
4	Paper 13-Theory FPT	4	4	40	60	100
	Paper 13- Practical	1	2	25	25	50
5	Paper 14 –Theory FM &FBP	4	4	40	60	100
	Paper 14 –Practical	1	2	25	25	50
6	Paper 15 – Theory QCPP	4	4	40	60	100
	Paper 15 -Practical	1	2	25	25	50
7	Field work/Project	3	3	40	60	100
	<b>Total</b>	<b>18</b>	<b>21</b>			
	<b>Grand Total</b>	<b>30</b>				
<b>SEMESTER-VI</b>						
	<b>INTERNSHIP</b> Training certificate Log book Presentaion Report submission Viva voce	<b>30</b>				<b>600</b>

**CHEMISTRY:: SEMESTER -V**

<b>V</b>	<b>V</b>	Analytical Methods in Chemistry-1 OR Analytical Methods in Chemistry-2	100	03	03
		Practical VI Analytical Methods in Chemistry-1 OR Analytical Methods in Chemistry2	50	02	01

## **Course 6-B: Analytical Methods in Chemistry-1**

**(ELECTIVE)** (30 hrs 3 h/week)

### **Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods

### **Unit-1: Quantitative analysis-1 6 h**

1. A brief introduction to analytical methods in chemistry.  
Concepts of volumetric analysis : concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.
2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration

### **Unit-2: Quantitative analysis-2 5 h**

1. Principles of volumetric analysis: Theories of acid-base , redox, complexometric titrations.
2. Iodometric and precipitation titrations.  
Additional inputs : Iodimetric titrations

**Note : No questions should be given in the semester end examinations from Additional inputs or Subject enrichment.**

### **Unit-3: Treatment of analytical data 5 h**

1. Errors: Definition. Significant figures and its importance. Types of errors- Relative & Absolute, Determinate & Indeterminate. Methods of minimization of errors.
2. Accuracy and Precision-Standard deviation and confidence interval.

#### **Unit-4: Separation techniques**

**8hours**

1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Application- Determination of Iron (III).
2. Ion Exchange method: Introduction, Types of ion exchange resins. applications.

#### **UNIT-5: Analysis of water**

**6 hours**

1. Definition and significance of Water quality parameters: Dissolved oxygen, BOD, COD, hardness of water - removal methods.
2. Determination of hardness of water, Dissolved oxygen, Chloride using Mohr's method.

#### **References**

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.West and Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & CoLtd.
6. Instrumental methods of Chemical Analysis by Gurudeep Chatwal, Himalaya publications.
7. The Instrumental methods of Chemical Analysis by B. K. Sarma.

## Course 6-B: Analytical Methods in Chemistry-1-

### Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Learn the procedure for the estimation of total hardness of water
2. Demonstrate the determination of chloride using Mohr's method
3. Acquire skills in the operation and calibration of pH meter
4. Perform the strong acid vs strong base titration using pH meter

### PRACTICALSYLLABUS (15hrs 2h/week) (Max.50 Marks)

1. Estimation of total hardness of water using EDTA.
2. Determination of chloride ion by Mohr's method
3. pH metric titration of strong acid vs. strong base,
4. pH metric titration of weak acid vs. strong base.

### References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

### Co-Curricular Activities:

**Mandatory:** (*Lab/field training of students by teacher* : ( lab: 10+ fields: 05):

**For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vs Strong base titration using pH meter, determination of chloride ion.

**For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe various methods used for the analysis of water. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited,

observations, findings, and acknowledgements. Unit tests (IE

## BLUE PRINT

### Course 6-B: Analytical Methods in Chemistry-1

S.No.	UNIT	NAME OF THE CHAPTER	8M	4M
1	Quantitative analysis -1	1. Introduction to analytical methods in chemistry	1	1
		2. Concepts of Volumetric Analysis	1	1
2	Quantitative analysis -2	1. Principles of Volumetric Analysis	1	1
		2. Principles of Gravimetric Analysis	1	1
3	Treatment of Analytical Data	1. Treatment of Analytical Data	2	2
4	Separation Techniques	1. Solvent Extraction	1	1
		2. Ion exchange	1	1
5	Analysis of Water	1. Analysis of Water	2	2

### Theory Evaluation: 100M

Internal (mid Test average)	Assignments	Seminar	Project	Total
10M	10M	10M	10M	40M

### Internal Assessment for Theory-40

External Assessment –60M

**Scheme of valuation**

**Practical Paper–VII B:: ANALYTICAL METHODS IN CHEMISTRY - 1**

Internal practical examination: 25M

<b>S.No.</b>	<b>Content</b>	<b>Marks</b>
1	Record	10M
2	Viva-voce	10M
3	Fieldvisit	05M
	Total	25M

External Practical Examination: 25M

**ANALYTICAL METHODS IN CHEMISTRY -1**

<b>S.No.</b>	<b>Content</b>	<b>Marks</b>
1	Experimental Procedure	10 M
2	Formula	5 M
3	Report	5 M
4	Calculation	5 M
	Total	25M

## MODEL PAPER

### SEMESTER V

#### Course 6-B: Analytical Methods in Chemistry-1

Time: 3h

Max. Marks : 60

#### PART A - Short Questions

Answer any **FIVE** of the following questions. Each carry **FOUR** marks     5 x 4 M = 20 M

1. What are Primary and secondary Standard Solutions? Give examples.
2. Explain ppm and ppb.
3. Explain principle of redox titrations.
4. Write about co-precipitation and post precipitation in gravimetric analysis.
5. Explain the importance of significant figures.
6. Write about methods of minimization of errors
7. Write about different types of resins used in Ion Exchange.
8. Explain the distribution law.
9. Write about BOD& COD.
10. Write a short note on TDS

#### PART B - Essay Questions

Answer all of the following questions. Each carries **EIGHT** marks     5 x 8 M = 40 M

11. (a) Discuss about different analytical methods in Chemistry.  
OR  
(b) Explain the principles of Volumetric Analysis.
12. (a) Explain different stages of gravimetric analysis.  
OR  
(b) Explain different theories of acid-base indicators.
13. (a) What is accuracy and precision explain with examples.  
OR  
(b) What is standard deviation? How it is calculated? Explain with one example.

14. (a) Explain the principle involved in Solvent extraction.

OR

(b) Explain the principle and method of Ion exchange.

15. (a) Explain Winkler's method of determining Dissolved Oxygen.

OR

(b) Discuss about the experimental determination of hardness of water

## QUESTION BANK

### Unit-1: Quantitative analysis-1

#### Short Answer Questions

1. What are Primary and secondary Standard Solution write with examples.
2. Explain ppm and ppb.
3. Explain concentration terms v/v and w/v with examples.

#### Essays

1. Discuss about different analytical methods in Chemistry.
2. Explain the terms Molarity, Molality, Normality
3. Explain the principles of Volumetric Analysis.

### Unit-2: Quantitative analysis-2

#### Short Answer Questions

1. Explain principle of redox titrations
2. Write about iodometry titrations.
3. Explain Precipitation titrations.
4. Write about co-precipitation and post precipitation in gravimetric analysis.

#### Essays

1. Discuss about complexometric titrations
2. Explain different theories of acid-base indicators.
3. Explain different stages of gravimetric analysis.

### Unit-3: Treatment of analytical data

#### Short Answer Questions

1. Explain determinate and indeterminate errors with examples.
2. Write about methods of minimization of errors
3. Explain the importance of significant figures.
4. Explain the concept of confidence interval with example.

#### Essays

1. What is accuracy and precision explain with examples.
2. Explain Absolute error & Relative error with examples.
3. What is standard deviation? How it is calculated? Explain with one example.

## **Unit-4: Separation techniques**

### **Short Answer Questions**

1. Explain the distribution law.
2. Explain the process of continuous extraction.
3. Explain the counter current extraction.
4. Write about the regeneration of resins.

### **Essays**

1. Explain the principle involved in Solvent extraction.
2. Explain the determination of Iron (III) by solvent extraction.
3. Explain the principle and method of Ion exchange.

## **UNIT-5: Analysis of water**

### **Short Answer Questions**

1. Write a short note on removal methods of Temporary Hardness of water.
2. Write about BOD & COD
3. Explain the hardness of water.

### **Essays**

1. Explain Winkler's method of determining Dissolved Oxygen.
2. Explain the method to determine hardness of Water.
3. Write about determining Chlorine in water by Mohr's method.

## **Course7-B: Analytical Methods in Chemistry-2**

**(ELECTIVE)** (30 hrs 3 h/week)

### **Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of chromatography in the separation and identification of compounds in a mixture
2. Acquire a critical knowledge on various chromatographic techniques.
3. Demonstrate skills related to analysis of water using different techniques.
4. Understand the principles of spectrochemistry in the determination of metal ions.
5. Comprehend the applications of atomic spectroscopy.

### **Course specific outcomes:**

On the completion of the course, the student will be able to do the following:

1. How to handle glassware, equipment, solvents and follow chromatographic separation procedures in laboratory.
2. The students will understand how to calculate  $R_f$  value on TLC technique, comparison of spots on TLC plates theoretical yield, and percentage of reaction carried out in the synthesis of organic compounds.
3. The student will learn how to perform common chromatographic laboratory techniques including separation of mixture, identification of compound, purity of sample and elution of compound in column chromatography.
4. How to create and carry out work up in synthesis of drugs and separation procedures
5. The student will understand how to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner.

## SYLLABUS

### **UNIT -1: Chromatography-Introduction and classification 6 h**

Principle. Classification of chromatographic methods based on principle, stationary & mobile phase. Types of adsorbents and eluents. Rf values and factors affecting Rf values.

### **UNIT-2: Paper and Thin layer Chromatography 8 h**

Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial Two dimensional paper chromatography. applications.

Thin layer chromatography: Principle, Experimental procedure, development of chromatogram, detection of spots, applications and advantages of TLC over PC.

### **Subject enrichment: Calculations of Rf values in separation of Amino Acids**

**Note : No questions should be given in the semester end examinations from Additional inputs or Subject enrichment.**

### **UNIT-3: Column Chromatography and HPLC 6 h**

Column chromatography: Principle, classification, Experimental procedure, applications.

HPLC: Basic principles, Classification of HPLC, Stationary phases, instrumentation (block diagram) and applications.

### **Subject Enrichment : Principle in Gas Chromatography**

**Note : No questions should be given in the semester end examinations from Additional inputs or Subject enrichment.**

### **UNIT-4: Spectrophotometry 6h**

Principle, Instrumentation: Single beam and double beam spectrometer. Beer- Lambert's law- Derivation and deviations from Beer-Lambert's law, applications of Beer- Lambert's law- Quantitative determination of Fe<sup>+2</sup>, Mn<sup>+2</sup>.

Subject enrichment : Simultaneous determination of Cr<sup>2+</sup> and Mn<sup>2+</sup>

**Note : No questions should be given in the semester end examinations from Additional inputs or Subject enrichment.**

**UNIT-5:Atomic spectroscopy**

**4h**

Principle and Instrumentation of atomic absorption and emission spectroscopy and applications

**Subject enrichment : Principle and technique in Flame Photometric Analysis.**

**Note : No questions should be given in the semester end examinations from Additional inputs or Subject enrichment.**

**References**

1. Fundamental so Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M. West and Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr.and A.L.Underwood, Sixth edition, Pearson.
4. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition/Pearson.

**Additional References:**

1. Instrumental Approach to Chemical Analysis by A.K. SRIVASTAVA , P.C. JAIN . S. CHAND Fourth Revised and enlarged Edition 2009, reprint 2012.
2. Analytical Chemistry by G L DAVID KRUPADANAM, D.VIJAYA PRASAD , K.VARAPRASADA RAO, KLN REDDY ,. Published by Orient longman Private Limited. Reprinted 2004.

## Course7-B: Analytical Methods in Chemistry-2-PRACTICAL SYLLABUS

### V. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the separation of a given dye mixture using TLC
2. Learn the preparation of TLC plates
3. Demonstrate the separation of mixture of amino acids using paper chromatography
4. Acquire skills in using column chromatography for the separation of dye mixture

### VI. Practical(Laboratory)Syllabus:(30hrs) (Max.50Marks)

1. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of triglycerides usingTLC
4. Verification of Beer lambert's law. (Using potassium permanganate solution) using colorimeter/spectrophotometer.
5. Demonstration – Separation of mixture of methyl orange and methylene blue by column chromatography
6. Demonstration- Separation of food dyes using Column Chromatography

### VII. LabReferences:

1. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Vogel A.I.Practical Organic Chemistry, Longman Group Ltd.
3. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
4. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
5. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

### VII. Co-Curricular Activities:

a) **Mandatory:**(*Lab/fieldtrainingofstudentsbyteacher(lab:10+field:05):*)

**For Teacher:** Training of students by the teacher in laboratory and field for notlessthan15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture using chromatographic techniques.

**ForStudent:** Student shall visit a related industry/chemistry laboratory in universities /research organizations/ private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork /project work report not

exceeding 10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work: *Title page, student details*, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

**Course specific outcomes:**

On the completion of the course, the student will be able to do the following:

1. How to handle glassware, equipment, solvents and follow chromatographic separation procedures in laboratory.
2. The students will understand how to calculate  $R_f$  value on TLC technique, comparison of spots on TLC plates theoretical yield, and percentage of reaction carried out in the synthesis of organic compounds.
3. The student will learn how to perform common chromatographic laboratory techniques including separation of mixture, identification of compound, purity of sample and elution of compound in column chromatography.
4. How to create and carry out work up in synthesis of drugs and separation procedures
5. The student will understand how to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner.

**COURSE : VIIB SEMESTER-V**  
**(Analytical Methods in Chemistry -2 )**

**BLUE PRINT**

**THIRD YEAR B.Sc., DEGREE EXAMINATION**

<b>S.NO</b>	<b>UNITS</b>	<b>NAME OF THE CHAPTER</b>	<b>8M</b>	<b>4M</b>
1	<b>Unit-I</b>	<b>Chromatography-Introduction and classification</b>	2	2
3	<b>Unit-II</b>	<b>TLC and paper chromatography</b>	2	2
		<b>1. Thin layer chromatography</b> <b>2. Paper Chromatography</b>		
4	<b>Unit-III</b>	Column chromatography	2	2
		<b>HPLC</b>		
5	<b>Unit-IV</b>	<b>Spectrophotometry</b>	2	2
	<b>Unit-V</b>	<b>Atomic spectroscopy</b>	2	2

**Theory-Evaluation: 100 M**

**Theory of Internal Assessment-40M**

<b>Internal (mid Test average)</b>	<b>Assignments</b>	<b>Seminar</b>	<b>Project</b>	<b>Total</b>
<b>10M</b>	<b>10M</b>	<b>10M</b>	<b>10M</b>	<b>40M</b>

**External Assessment –60M**

Scheme of valuation

**Practical Paper–VII B:: ANALYTICAL METHODS IN CHEMISTRY -2**

**I. Internal practical examination: 25M**

S. No.	Content	Marks
1	Record	10M
2	Viva-voce	10M
3	Field visit	05M
	Total	25M

**II. External Practical Examination: 25M**

**ANALYTICAL METHODS IN CHEMISTRY -2**

S. No.	Content	Marks
1	Experimental Procedure	10 M
2	Separation of compounds	5 M
3	Report	5 M
4	Calculation of R <sub>f</sub> values	5 M
	Total	25M

**MODEL PAPER**

**AMIC -2**

**THIRD YEAR B.Sc., DEGREE EXAMINATION**

**SEMESTER-V**

**CHEMISTRY COURSE-VIIB : ANALYTICAL METHODS IN  
CHEMISTRY -2**

Time: 3 hours

Maximum Marks: 60

**PART-A**

5X4=20 Marks

Answer any **FIVE** of the following questions.

Each question carries **FOUR** marks

1. What is  $R_f$  value? Explain the factors effecting on  $R_f$  values .
2. Describe the development of chromatogram in paper chromatography.
3. Write about the stationary and mobile phases present in column chromatography.
4. Write about the various techniques used for the development in thin layer chromatography.
5. Explain the difference between absorption and emission spectra.
6. Discuss the applications of emission spectroscopy in qualitative analysis .
7. Explain applications of Beer -Lambert's law
8. Write about the important applications of column chromatography .
9. Write about the classification in High- Performance Liquid Chromatography (HPLC) .
10. Discuss about the Elutropic series

**PART-B**

5X8=40 Marks

Answer **ALL** the questions.

Each carries **EIGHT** marks:

11. a) Classify the chromatographic methods based on the nature of the

Stationary phase and the nature of the mobile phase.

OR

*b)* Explain the experimental procedure of paper chromatography . Write its applications

12.a) What is Thin layer chromatography ? Describe the experimental procedure in Thin layer chromatography.

OR

*b)* Explain with a neat diagram in the technique of two-dimensional paper chromatography. Write the applications of two dimensional paper chromatography.

13.a) Explain the basic principle of HPLC and write the applications of HPLC.

OR

*b)* Explain the principle and Applications of Column chromatography

14. a) Derive Beer -Lambert's law and write the deviation of Beer-Lambert's law.

OR

*b)* Explain the principle and instrumentation of double beam spectrophotometer

15. a) Explain briefly the types of atomic spectroscopy .

OR

*b)* Explain the principle and instrumentation of Atomic absorption spectroscopy.

# **ZOOLOGY SYLLABUS**

**ZOOLOGY PAPER – V**  
**ANIMAL BIOTECHNOLOGY**

**ZOOLOGY PAPER – VI**  
**IMMUNOLOGY**

## Theory syllabus

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**ZOOLOGY PAPER – V**  
**ANIMAL BIOTECHNOLOGY**

### Course Outcomes

- Gain knowledge on animal cell and tissue culture and their preservation
- Empowered with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- Explain in vitro fertilization, embryo transfer technology and other reproduction manipulation methodologies.
- Acquire insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.

### SYLLABUS

#### **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

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## Practical syllabus

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**ZOOLOGY PAPER – V**  
**ANIMAL BIOTECHNOLOGY**

### PRACTICAL SYLLABUS

#### 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.

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*Theory marks allotment*

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY THEORY  
Semester-V  
ZOOLOGY PAPER – V  
ANIMAL BIOTECHNOLOGY**

**Theory- Internal**

**Total Marks: 40**

1. Internals (2) Average	: 10 marks
2. Project	: 10 marks
2. Assignments (2)	: 5x2=10marks
3. Seminar	: 5 marks
4. Viva voce	: 5marks

**Theory- External**

**Total Marks: 60**

**Section –A**

Short Answer questions 1 to 10 (Any 5 from given 10)	5×4=20
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**Section –B**

Essay Questions 11 to 15 (With internal choice)	5×8=40
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**Total – 60 Marks**

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*Practical marks allotment*

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY PRACTICAL MARKS ALLOTMENT  
Semester-V  
ZOOLOGY PAPER – V  
ANIMAL BIOTECHNOLOGY**

**Practical's – External:**

**Time: 2 hrs.**

**Total Marks: 25**

- |  |                  |
|--|------------------|
| 1. Major dissection<br>(Identification – 2M ; Diagram – 3 M ; Labelling – 3 M) | : 8 marks        |
| 2. Minor experiment  | : 4 marks        |
| 3. Identification of specimens / diseases (2) – slides/pictures<br>= 8)        | : 8 marks (4 x2) |
| 4. Viva voce   | : 5 marks        |

**Practical's – Internal :**

**Total Marks: 25**

- |                    |            |
|--------------------|------------|
| 1. Assessment (2)  | : 10 marks |
| 2. Record          | : 10 marks |
| 3. Field note book | : 5 marks  |

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**Question Paper Blue Print**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY THEORY  
Semester-V  
ZOOLOGY PAPER – V  
ANIMAL BIOTECHNOLOGY**

**BLUE PRINT MODEL FOR EXTERNAL EXAMINATIONS**

**60 Marks**

	Section A Short Questions			Section B Essay Questions		
	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS
UNIT –I	02	4	8	02	8	16
UNIT-II	02	4	8	02	8	16
UNIT-III	02	4	8	02	8	16
UNIT-IV	02	4	8	02	8	16
UNIT-V	02	4	8	02	8	16

**Section-A:** Questions numbers 1 to 10, Out of 10 Questions 5 has to be answered.

**Section-B:** Questions numbers 11 to 15, Internal Choice (either / or) and 5 Questions has to be answered.

**1. Short Questions : 5 x 4 = 20**

**2. Essay Questions : 5 x 8 = 40**

**Total – 60 marks**

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**Model question paper**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY THEORY  
Semester-V  
ZOOLOGY PAPER – V  
ANIMAL BIOTECHNOLOGY**

**SECTION – A**

*Answer any FIVE of the following  
Draw diagrams wherever necessary*

**5 x 4 = 20**

1. DNA Polymerases
2. Cosmids
3. Electroporation
4. PCR
5. Organ culture
6. Cryopreservation
7. Super ovulation
8. Embryo cloning
9. Centrifugation
10. DNA fingerprinting

**SECTION –B**

*Answer any FIVE of the following  
Draw diagrams wherever necessary*

**5 x 8 = 40**

11. a. Explain different types of restriction enzymes used in genetic engineering

Or

b. Write an essay on cloning vectors

12. a. Explain the preparation of genomic and c- DNA libraries

Or

b. Write an essay on Sanger's method of DNA sequencing

13. a. Give an account on production of MAB's and its applications

Or

b. Describe the different types of stem cells and its applications

14. a. What do you understand by IVF. How it is done?

Or

b. What is transgenesis and explain its application in animals

15. a. Explain the steps involved in Down stream processing of fermentation

Or

b. Explain monoculture and polyploidy in fishes

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## Theory syllabus

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**ZOOLOGY PAPER – VI**  
**IMMUNOLOGY**

### Course Outcomes

- Trace the history and development of immunology
- Explain the immunological processes
- Understand the role of immune system in health and disease
- Able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major Histo compatibility Complex in terms of immune response and transplantation

### **SYLLABUS**

#### **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.
  - 3.1.3 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 - 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

### **Suggested Readings**

Arthur C. Guyton MD, A Text Book of Medical Physiology, Eleventh ed., John E. Hall, Harcourt Asia Ltd. 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, Johanthan Brostoff, 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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## Practical syllabus

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**ZOOLOGY PAPER – VI**  
**IMMUNOLOGY**

### **Practical (Laboratory) Syllabus:**

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

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**Theory marks allotment**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
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III B. Voc ZOOLOGY THEORY  
Semester-V  
ZOOLOGY PAPER – VI  
IMMUNOLOGY**

**Theory- Internal**

**Total Marks: 40**

- |                              |            |
|------------------------------|------------|
| 1. Internals (2) Best of Two | : 10 marks |
| 2. Project                   | : 10 marks |
| 2. Assignment                | : 10marks  |
| 3. Seminar                   | : 5 marks  |
| 4. Viva voce                 | : 5marks   |

**Theory- External**

**Total Marks: 60**

**Section –A**

Short Answer questions 1 to 10 (Any 5 from given 10) 5×4=20

**Section –B**

Essay Questions 11 to 15 (With internal choice) 5×8=40

**Total – 60 marks**

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**Practical marks allotment**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY PRACTICAL MARKS ALLOTMENT  
Semester-V  
ZOOLOGY PAPER – VI  
IMMUNOLOGY**

**Practical's – External:**

**Total Marks: 25**

- |                     |            |
|---------------------|------------|
| 1. Major Experiment | : 12 marks |
| 2. Minor Experiment | : 8 marks  |
| 3. Viva voce        | : 3 marks  |

**Practical's – Internal:**

**Total Marks: 25**

- |                    |            |
|--------------------|------------|
| 1. Assessment      | : 10 marks |
| 2. Record          | : 10 marks |
| 3. Field note book | : 5 marks  |

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## Question Paper Blue Print

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc ZOOLOGY THEORY**  
**Semester-V**  
**ZOOLOGY PAPER – VI**  
**IMMUNOLOGY**

**BLUE PRINT MODEL FOR EXTERNAL EXAMINATIONS**

**60 Marks**

	Section A Short Questions			Section B Essay Questions		
	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS
UNIT –I	02	4	8	02	8	16
UNIT-II	02	4	8	02	8	16
UNIT-III	02	4	8	02	8	16
UNIT-IV	02	4	8	02	8	16
UNIT-V	02	4	8	02	8	16

**Section-A:** Questions numbers 1 to 10. Out of 10 Questions 5 has to be answered.

**Section-B:** Questions numbers 11 to 15 Internal Choice (either / or) and 5 Questions has to be answered.

- 1. Short Questions :** **5 x 4 = 20**  
**2. Essay Questions :** **5 x 8 = 40**

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**Model Question Paper**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY THEORY  
Semester-V  
ZOOLOGY PAPER – VI  
IMMUNOLOGY**

**SECTION – A**

*Answer any FIVE of the following  
Draw diagrams wherever necessary*

**5 x 4 = 20**

1. Phagocytosis
2. Passive immunity
3. Haptens and Adjuvants
4. Interferons
5. IgG Structure
6. Applications of MonoClonalAntibodies
7. Functions of MHC
8. Action of Cytokines
9. Delayed hypersensitivity
10. Vaccines

**SECTION – B**

*Answer any FIVE of the following  
Draw diagrams wherever necessary*

**5 x 8 = 40**

11. a. What is the difference between Innate and Adaptive immunity  
Or  
b. Explain primary group of immune system organs
12. a. Explain types of antigens  
Or  
b. What are the properties of T- Cell Epitopes
13. a. Explain the structure of a typical antigen  
Or  
b. What are the functions of Immunoglobulins – Explain
14. a. Explain endogene pathway of antigen  
Or  
b. What are the functions of Cytokines – Explain
15. a. Explain types of hypersensitivities  
Or  
b. Explain types of vaccines

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**Semester-V**

**SKILL PAPER - XIII**  
**FISH PROCESSING TECHNOLOGY**

**SKILL PAPER – XIV**  
**FISHERY MICROBIOLOGY AND FISHERY BY-**  
**PRODUCTS**

**SKILL PAPER – XV**  
**QUALITY CONTROL IN PROCESSING PLANTS**

## Theory syllabus

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B. Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc ZOOLOGY THEORY**  
**Semester-V**  
**SKILL PAPER – XIII**  
**FISH PROCESSING TECHNOLOGY**

### Course Outcomes

- Identify the types of preservation methods employed in aquaculture
- Choose the suitable Processing methods in aquaculture
- Define chemical composition of fish and shellfish
- Specify methods of handling of fish
- Discuss by products of fish processing

### **SYLLABUS**

#### **Unit 1**

Introduction: Principles of fish preservation. Importance of hygiene and sanitation in fish handling. Quality of water and ice in fish handling and processing. Preparation of ice. Different types of ice used in the seafood industry and their merits. Preservation by refrigerated seawater and chilled sea water

#### **Unit 2**

Freezing and Canning: Fundamental principles involved in chilling and freezing of fish and fishery products. Various freezing methods. Freezing of shrimps and fishes. Changes during the cold storage of fish and fishery products. Principles involved in canning of fish. Different types of containers. Different stages of canning of Tuna. Retortable pouch processing.

#### **Unit 3**

Drying, Smoking and Freeze-drying: (9 Hrs) Principles of smoking, drying and salting of fish, factors affecting drying. Traditional drying / curing methods. Different types of drying. Drying of fish and prawns. Packing and storage of dried products. Spoilage of dried products. Preventive measures. Standards for dry fish products. Cold smoking. Principles of freeze drying. Accelerated freeze drying and packing of freeze dried products. Modern methods of preservation by irradiation and modified atmospheric storage.

#### **Unit 4**

Packing, Cold Storage and Export of Fishery Products: Functions of packing. Different types of packing materials and its quality evaluation. Packing requirements for frozen and cured products. Statutory requirements for packing. Labeling requirements. Different types of cold storages. Insulated and refrigerated vehicles.

#### **Unit 5**

Export of fishery products from India - major countries, important products, export documents and procedures. Prospects and constraints in export including tariff and non- tariff barriers, marine insurance, export incentives, registered exporters

**Reference Books:**

1. A.M.Martin, Fisheries – Processing Chapman & Hall, Madras
2. Ed.G.M.Hall –Fish Processing Technology Chopra & Hall. Madras.

**Text books:**

1. K.Gopakumar, Fish Processing Technology, ICAR, New Delhi
2. T.K. Govindan, Fish Processing Technology Oxfor & IBH Publication Co.
3. K.K. Balachandran Fish Canning – Principles & Practices.
4. Borgstrom,G. Fish as Food.
5. K.K. Balachandran, Postharvest Technology in Fish and Fishery Products.
6. Moorjani,M.V. Fish Processing in India.
7. Connell,J.J. Advances in Fishery science and Technology.
8. CIFT. Manual of Quality Control in Fish and Fishery Products.
9. Gopakumar,K. Fish Packaging Technology

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**Practical syllabus**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY**

**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**

**III B. Voc ZOOLOGY THEORY**

**Semester-V**

**SKILL PAPER – XIII**

**FISH PROCESSING TECHNOLOGY**

1. Determination of moisture content in fish and fishery products
2. General description – freezing
3. Shrimp processing
4. Drying of fish
5. Organoleptic analysis of fish
6. Preparation of fishery by-products
7. Preparation of shark finrays, fish maws, chitin, fish wafer.

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**Theory marks allotment**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY THEORY  
Semester-V  
SKILL PAPER – XIII  
FISH PROCESSING TECHNOLOGY**

**Theory- Internal**

**Total Marks: 40**

- |                              |               |
|------------------------------|---------------|
| 1. Internals (2) Best of Two | : 10 marks    |
| 2. Project                   | : 10 marks    |
| 2. Assignments (5)           | : 5x2=10marks |
| 3. Seminar                   | : 5 marks     |
| 4. Viva voce                 | : 5marks      |

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**Theory- External**

**Total Marks: 60**

**Section –A**  
Short Answer questions 1 to 10 (Any 5 from given 10)      5x4=20

**Section –B**  
Essay Questions 11 to 15 (With internal choice)      5x8=40

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**Practical marks allotment**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc ZOOLOGY PRACTICAL MARKS ALLOTMENT  
Semester-V  
SKILL PAPER – XIII  
FISH PROCESSING TECHNOLOGY**

**Practical's – External:**

**Total Marks: 25**

- |   |                     |
|---|---------------------|
| 1. Preparation of temporary slide       | : 6 marks           |
| 2. Identification and write characters  | : 6 marks           |
| 3. Identification (2) – slides/pictures | : 5 marks (2x2 1/2) |
| 4. Record                               | : 5 marks           |
| 5. Viva voce                            | : 3 marks           |

**Practical's – Internal :**

**Total Marks: 25**

- |                                   |           |
|-----------------------------------|-----------|
| 1. Assessment including viva voce | : 6 marks |
| 2. Record                         | : 6 marks |
| 3. Field note book                | : 5 marks |
| 4. Project                        | : 8 marks |

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## Question paper Blue Print

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc ZOOLOGY THEORY**  
**Semester-V**  
**SKILL PAPER – XIII**  
**FISH PROCESSING TECHNOLOGY**  
**BLUE PRINT MODEL FOR EXTERNAL EXAMINATIONS**

	Section A			Section B		
	Short Questions			Essay Questions		
	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS
UNIT - I	02	4	8	02	8	16
UNIT-II	02	4	8	02	8	16
UNIT-III	02	4	8	02	8	16
UNIT-IV	02	4	8	02	8	16
UNIT-V	02	4	8	02	8	16

**Section-A:** Questions numbers 1 to 10, Out of 10 Questions 5 has to be answered.

**Section-B:** Questions numbers 11 to 15, Internal Choice (either / or) and 5 Questions has to be answered.

1. Short Questions : 5 x 4 = 20
2. Essay Questions : 5 x 8 = 40

**Total : 60 Marks**

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**Model Question Paper**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY**

**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**

**III B. Voc ZOOLOGY THEORY**

**Semester-V**

**SKILL PAPER – XIII**

**FISH PROCESSING TECHNOLOGY**

**SECTION-A**

*Answer any FIVE of the following*

**5x4=20**

*Draw labelled diagrams wherever necessary*

1. Types of ice used in sea food industry
2. Chilled sea water preservation
3. Canning
4. Types of containers
5. Smoking
6. Traditional drying
7. Low density poly ethylene(LDPE) & High density poly ethylene(HDPE)
8. Insulated vehicles
9. Marine insurance
10. Export incentives

**SECTION-B**

*Answer any FIVE of the following*

**5x8=40**

*Draw labelled diagrams wherever necessary*

11. a. Describe three methods of storing fish in ice on fishing vessels  
(or)  
b. Explain importance of hygiene & sanitation in fish handling
12. a. Explain principle, methods & application in freezing of fish  
(or)  
b. Explain principles involved in canning of fish
13. a. Explain salting & drying methods in fish preservation  
(or)  
b. Explain different packing & storage methods of fish & prawn dried products
14. a. Explain packing used in freshwater fish processing  
(or)  
b. Describe different types of cold storages
15. a. Discuss export documents & procedures of fish & prawn  
(or)  
b. Discuss tariff & non-tariff barriers in exporting fish & prawn

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## Theory syllabus

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**SKILL PAPER – XIV**  
**FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**

### Course Outcomes

- Identify the Microorganisms associated with aquatic environment and fish and their role in spoilage of fish.
- Know the Historical development in food microbiology.
- Explain the Role of microorganisms in aquatic environment and sources of entry of microorganisms to foods.

### **SYLLABUS**

#### **Unit 1:**

Introduction: History and development of microbiology –Different members of the microbial community – General characteristics of bacteria, fungi, viruses, algae and protozoans.

Ultrastructure of prokaryotic cell – structure and function of bacterial cell wall, plasmamembrane, capsule, flagella and endospore. Structure of fungi and yeast cell. Ultrastructure of virus – classification of viruses, Life cycle bacteriophages - lytic and lysogenic cycle.

#### **Unit 2:**

Aquatic Microbiology: Microflora of aquatic environment, Different culture techniques.

Nutrition and growth of bacteria – different types of media for isolation of bacteria and fungi.

Isolation, enumeration, preservation and maintenance of cultures. Routine tests for identification of bacteria – morphological, cultural biochemical and serological. Basics of mycological and virological techniques.

#### **Unit 3:**

Fish Microbiology: Perishability of seafood – Fish as an excellent medium for growth of microorganisms. Spoilage microflora of fish and shellfish. Intrinsic and extrinsic factors affecting spoilage.

#### **Unit 4:**

Fishery By-Products: Fish meal, fish protein concentrate, shark fin rays, fish maws, isinglass, fish liver oil, fish body oil, fish hydrolysates, chitin, chitosan, glucosamine hydrochloride, squalene, pearl essence, ambergris, gelatin, beche-de-mer, fish silage, fish ensilage and seaweed products like agar, alginic acid and carragenan.

#### **Unit 5:**

Value Added Products. Value addition in sea food. Different types of value added products from fish and shell fishes – status of value addition in Indian seafood sector. Advantages of value addition. Fish mince and Surimi. Analog and fabricated products. Preparation of coated fishery products. Different types of batter and breading and its applications. Preparation of products viz.

fish / prawn pickle, fish wafers, prawn chutney powder, fish soup powder, fish protein hydrolysate, fish stacks, fillets, fish curry, mussel products, marinated products.

**Text Books:**

1. Pelzar, Reid & Chan – Microbiology
2. Prescott, Harley & Klein – Microbiology
3. Adeloger, Ingra & Wheates – Introduction to Microbial World
4. Windsor and Barlow. Introduction to Fishery Byproducts.
5. CIFT. Proceedings on Summer Institute on Non-traditional Diversified Fish Products&Byproducts.
6. Anon. Productivity in Aquatic Bodies.
7. Chincheste,C.O. and Graham,H.D. Microbial Safety of Fishery Products.
8. Amerine,M.A. and Pangborm,R.M. Principles of Sensory Evaluation of Foods.
9. Connell,J.J. Control of Fish Quality
10. Bigh,E.G. Seafood Science and Technology
11. Gopakumar.K Tropical Fishery Products

**Reference Books**

1. Kreuzer,R. Fishery Products.
2. Borgstrom,G .Fish as Food
3. Suzuki,T. Fish and Krill Protein: Processing Technology

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## **Practical Syllabus**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc Aquaculture Technology  
Semester-V  
SKILL PAPER – XIV  
FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**

1. Sterilization techniques
2. Preparation of culture media
3. Enumeration of total coliforms
4. Enumeration of bacteria by TPC method
5. Gram staining of bacteria
6. Isolation and identification of pathogen bacteria in edible fish
7. Evaluation of fish/fishery products for organoleptic, chemical, microbial quality

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**Theory marks allotment**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
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III B. Voc Aquaculture Technology  
Semester-V  
SKILL PAPER – XIV  
FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**

**Theory- Internal**

**Total Marks: 40**

- |                              |               |
|------------------------------|---------------|
| 1. Internals (2) Best of Two | : 10 marks    |
| 2. Project                   | : 10 marks    |
| 2. Assignments (5)           | : 5x2=10marks |
| 3. Seminar                   | : 5 marks     |
| 4. Viva voce                 | : 5marks      |

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**Theory- External**

**Total Marks: 60**

**Section –A**

Short Answer questions 1 to 10 (Any 5 from given 10)      5x4=20

**Section –B**

Essay Questions 11 to 15 (With internal choice)      5x8=40

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**Practical marks allotment**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
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Semester-V  
SKILL PAPER – XIV  
FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**

**Practical's – External:**

**Total marks - 25**

- |                     |            |
|---------------------|------------|
| 1. Major experiment | : 12 marks |
| 2. Minor experiment | : 8 marks  |
| 3. Viva voce        | : 5 marks  |

**Practical's – Internal:**

**Total Marks: 25**

- |                    |            |
|--------------------|------------|
| 1. Assessment      | : 10 marks |
| 2. Record          | : 10 marks |
| 3. Field note book | : 5 marks  |

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## Question Paper Blue Print

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**SKILL PAPER – XIV**  
**FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**

### BLUE PRINT MODEL FOR EXTERNAL EXAMINATIONS

**Section-A:** Questions numbers 1 to 10, Out of 10 Questions 5 has to be answered.

	Section A			Section B		
	Short Questions			Essay Questions		
	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS
UNIT –I	02	4	8	02	8	16
UNIT-II	02	4	8	02	8	16
UNIT-III	02	4	8	02	8	16
UNIT-IV	02	4	8	02	8	16
UNIT-V	02	4	8	02	8	16

**Section-B:** Questions numbers 11 to 15, Internal Choice (either / or) and 5 Questions has to be answered.

1. Short Questions : 5 x 4 = 20
2. Essay Questions : 5 x 8 = 40

**Total : 60 Marks**

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**Model Question Paper**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc Aquaculture Technology  
Semester-V  
SKILL PAPER – XIV  
FISHERY MICROBIOLOGY AND FISHERY BY-PRODUCTS**

**Time: 3 hrs**

**Max Marks: 60**

**SECTION-A**

*Answer any FIVE of the following*

**5x4=20**

*Draw labelled diagram wherever necessary*

1. Endospore
2. Structure of prokaryotic cell
3. Anaerobic media
4. Oxidase test
5. Luminescent bacteria
6. Oxygen concentration
7. Fish liver oil
8. pearl essence
9. Advantages of value addition products
10. Fish mince

**SECTION-B**

*Answer any FIVE of the following*

**5x8=40**

*Draw labeled diagram wherever necessary*

11. a. Describe the structure & function of plasma membrane  
(or)  
b. Explain lifecycle of bacteriophage with lytic & lysogenic cycles
12. a. Explain different types of media for isolation for bacteria  
(or)  
b. Explain different culture techniques & isolation of fungi
13. a. Explain spoilage microflora of shell fish  
(or)  
b. Describe extrinsic factors affecting fish spoilage
14. a. Explain any four fish by products  
(or)  
b. Explain production of agar
15. a. Describe the status of value addition & advantages Indian seafood sector  
(or)  
b. Explain battered & breaded fish products

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## **Theory syllabus**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**SKILL PAPER – XV**  
**QUALITY CONTROL IN PROCESSING PLANTS**

### **Course Outcomes**

- Identify the best Seafood quality assurance system
- Identify the quality of aqua processed products.
- Determine the quality of fishery by products by observation
- Analyze the protocols of aqua processing methods

### **SYLLABUS**

#### **Unit I:**

Quality management, total quality concept and application in fish trade. Quality assessment of fish and fishery products - physical, chemical, organoleptic and microbiological quality standards. Quality Assurance-Inspection and quality assurance:

#### **Unit 2:**

Fish inspection in India, process water quality in fishery industry, product quality. Water analysis, treatments, chlorination, ozonisation, UV radiation, reverse osmosis, techniques to remove pesticides and heavy metals.

#### **Unit 3:**

Sensory evaluation of fish and fish products, basic aspects, different methods of evaluation, taste panel selection & constitution, statistical analysis Quality problem in fishery products: good manufacturing practices. HACCP and ISO 9000 series of quality assurance system, validation and audit. national and international standards, EU regulation for fish export trade,

#### **Unit 4:**

IDP and SAT formations in certification of export worthiness of fish processing units, regulations for fishing vessels pre-processing and processing plants, eu regulations. Factory sanitation and hygiene: National and international requirements, SSOP.

#### **Unit 5:**

Hazards in sea foods: Sea food toxins, biogenic amines, heavy metals and industrial pollutants. Infection and immunity, Microbial food poisoning, bacteria of public health significance in fish / fishery products / environments - Salmonella, Clostridia, Staphylococcus, E. coli, Streptococcus, Vibrio, Aeromonas, Listeria, Yersinia, Bacillus. Laboratory techniques for detection and identification of food poisoning bacteria. Mycotoxins in cured fish, bacterial associated with fish disease.

**Reference Books**

1. Ellis Harward. 18 Felix S, Riji John K, Prince Jeyaseelan MJ & Sundararaj V. 2001  
Bacterial Fish Pathogens (Diseases in Farm and Wild)
2. Fish Disease Diagnosis and Health Management. Fisheries College and Research  
Institute, T.N. Veterinary and Animal Sciences University. Thoothukkudi. Inglis V, Roberts RJ  
& Bromage NR. 1993.

**Practical syllabus**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc ZOOLOGY THEORY**  
**Semester-V**  
**SKILL PAPER – XV**  
**QUALITY CONTROL IN PROCESSING PLANTS**

Project work



## Question Paper Blue Print

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA**  
**DEPARTMENT OF ZOOLOGY**  
**B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)**  
**III B. Voc Aquaculture Technology**  
**Semester-V**  
**SKILL PAPER – XV**  
**QUALITY CONTROL IN PROCESSING PLANTS**  
**BLUE PRINT MODEL FOR EXTERNAL EXAMINATIONS**

	Section A			Section B		
	Short Questions			Essay Questions		
	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS	NO OF QUESTIONS	MARKS ALLOTTED FOR EACH QUESTION	TOTAL MARKS
UNIT –I	02	4	8	02	8	16
UNIT-II	02	4	8	02	8	16
UNIT-III	02	4	8	02	8	16
UNIT-IV	02	4	8	02	8	16
UNIT-V	02	4	8	02	8	16

**Section-A:** Questions numbers 1 to 10, Out of 10 Questions 5 has to be answered.

**Section-B:** Questions numbers 11 to 15, Internal Choice (either / or) and 5 Questions has to be answered.

1. Short Questions :  $5 \times 4 = 20$
2. Essay Questions :  $5 \times 8 = 40$

**Total : 60 Marks**

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**Model Question Paper**

**SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA  
DEPARTMENT OF ZOOLOGY  
B Voc., COURSE IN AQUACULTURE TECHNOLOGY (w. e. f – 2021-22)  
III B. Voc Aquaculture Technology  
Semester-V  
SKILL PAPER – XV  
QUALITY CONTROL IN PROCESSING PLANTS**

**Time: 3 hrs**

**Max Marks: 60**

**SECTION-A**

*Answer any FIVE of the following*

**5x4=20**

*Draw labeled diagram wherever necessary*

1. Objectives of Quality control
2. Organoleptic quality assessment of fish
3. Chlorination
4. BOD and COD
5. GMPs
6. ISO 9000 series
7. Regulations for fishing vessels
8. SSOP
9. Heavy metals in sea foods
10. Mycotoxins in cured fish

**SECTION-B**

*Answer any FIVE of the following*

**5x8=40**

*Draw labeled diagram wherever necessary*

11. a. Describe the chemical & microbiological methods in quality assessment of fish  
(or)  
b. Explain quality assurance of sea food products
12. a. Write about the quality control and pre-shipment inspection of fish and fishery products.  
(or)  
b. Explain various techniques to remove heavy metals
13. a. Explain about different sensory evaluation methods of fish & fish products  
(or)  
b. What is meant by HACCP? Explain the principles in HACCP.
14. a. Describe IDP & SAT formation in certificate of fish processing units  
(or)  
b. Write an essay on fish factory sanitation & hygiene
15. a. Write briefly about different sea food toxins.  
(or)  
b. Write about any six bacteria which are of public health significance in fish and fishery products.

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