FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A" Grade by NAAC (3rd Cycle)
74th Rank in India Ranking 2020 (NIRF) by MHRD
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT : ZOOLOGY

NAME OF THE PROGRAMME : M.Sc. ZOOLOGY

PROGRAMME CODE : PSZO

ACADEMIC YEAR : 2020 - 2021

2020 - 2021

Minutes of the PG Board of Studies meeting held on 28.02.2020 at 2.00 pm in the Zoology Lab, Department of Zoology, Fatima college (Autonomous), Madurai-18

Members of the PG Board of Zoology:

1. Dr. K.S. Malar (University Nominee)
2. Dr. F. Brisca Renuga (Subject Expert-Zoology)
3. Dr. D. Illakkiam (Subject Expert-Zoology)
4. Dr. C. Gowri Priya (Scientist)
5. Dr. M. Kalaiarasi (Alumnus) 28/02/2020
6. Dr. B. Karunai Selvi (Subject Expert-Botany) 28/02/2020
7. Dr. N. Malathi (Academic Dean) 28/2/2020
8. Dr. A. Tamil Selvi 28/02/2020
9. Dr. Antony Amala Jaya Seeli 28/02/2020
10. Dr. N. Malathi
11. Dr. J. Asnet Mary 28/2/2020
12. Dr. Sr. Biji Cyriac
13. Dr. V. Bharathy
14. Dr. N. Nagarani
15. Dr. S. Barathy
16. Ms. T. Malar Meenakshi

The suggestions and the changes carried out in the I & II semester syllabi of I M.Sc Zoology during the PG Board of Studies - Annual Upgradation of Syllabus Meeting of Zoology (2019-2020) were presented briefly as the Action Taken Report.

The course contents as well as the Course Outcomes (CO) for all the courses of

II M.Sc Zoology were presented in the Board. The following courses were reviewed and approved in the Board of Studies Meeting.

Semester III 1) Biophysics (19PG3Z11)
2) Immunology (19PG3Z12)
3) Biostatistics & Research Methodology (19PG3Z13)

Elective - Fisheries & Aquaculture / Bioinformatics (19PG3ZE1/ 19PG3ZE2)

Lab in Biophysics & Biostatistics & Lab in Immunology, Fisheries & Aquaculture and Bioinformatics. (19PG3Z14 & 19PG3Z15)

Semester IV. 1) Environmental Biology (19PG4Z16)
2) Biotechnology (19PG4Z17)
3) Developmental Biology (19PG4Z18)

Elective - Economic Zoology / Ethology. (19PG4ZE3/ 19PG4ZE4)

Lab in Environmental Biology & Developmental Biology (19PG4Z19)

Lab in Biotechnology, Economic Zoology & Ethology (19PG4Z20)

The Self Learning course - 'Vector Borne Diseases' (19PGSLZ1) and PG offclass course - 'SPSS' were scrutinized & approved by the Board members. Self study topics of I PG & II PG courses were discussed with the Board Members & approved by the Board. A List of Mooc online courses, List of Practical/Project Viva examiners and a List of Institutions/Research centres offering Internship for our M.Sc students were also presented in the Board. The current practice followed in the UG Extension/ outReach programme were shared with the Board Members and their suggestions regarding the implementation of 'Service Learning programme for PG students were noted down.

Feedback/Evaluation for the course contents and the curriculum were also received from the External members of Annual Upgradation of Syllabus - Board of Studies Meeting for the Academic year 2020-2021.

1. Dr. K.S. Malar
2. Dr. F. Brisca Renuga
3. Dr. D. Illakkiam
4. Dr. C. Gowri Priya
5. Dr. M. Kalaiarasi
6. Dr. B. Karunai Selvi
7. Dr. N. Malathi
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9. Dr. Antony Amala Jayaseeli
10. Dr. N. Malathi
11. Dr. J. Asnet Mary
12. Dr. Sr. Biji Cyriac
13. Dr. V. Bharathy
14. Dr. N. Nagarani
15. Dr. S. Barathy
16. Ms. J. Malar Meenakshi

28/02/2020

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF ZOOLOGY

M.Sc Zoology- Syllabus Front Page

2020-2021

For those who joined in June 2019 onwards

PROGRAMME CODE: PSZO

COURSE CODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
SEMESTER - I						
19PG1Z1	Animal Diversity	6	4	40	60	100
19PG1Z2	Microbiology	6	4	40	60	100
19PG1Z3	Cell & Molecular biology	6	4	40	60	100
19PG1Z4	Lab in Animal Diversity& Microbiology	4	2	40	60	100
19PG1Z5	Lab in Cell & Molecular Biology	4	2	40	60	100
19PGZEDC1	Herbal Medicine	3	3	40	60	100
	Library	1	-	-	-	-
Total		**30**	**19**			
SEMESTER - II						
19PG2Z6	Genetics	6	4	40	60	100
19PG2Z7	Evolution	6	4	40	60	100
19PG2Z8	Biochemistry	6	4	40	60	100
19PG2Z9	Lab in Genetics & Evolution	4	2	40	60	100
19PG2Z10	Lab in Biochemistry	4	2	40	60	100
19PGZEDC2	Herbal Medicine	3	3	40	60	100
	Library	1		-	-	-
Total		**30**	**19**			
SEMESTER - III						
19PG3SIZ1	Internship/Summer Project*	-	3	50	50	100
19PG3Z11	Biophysics	6	5	40	60	100
19PG3Z12	Immunology	6	5	40	60	100
19PG3Z13	Biostatistics & Research Methodology	6	5	40	60	100
19PG3ZE1/ 19PG3ZE2	Fisheries & Aquaculture / Bioinformatics	4	4	40	60	100
19PG3Z14	Lab in Biophysics & Biostatistics	4	2	40	60	100
19PG3Z15	Lab in Immunology, Fisheries & Aquaculture	4	2	40	60	100

	and Bioinformatics					
Total		**30**	**26**			
SEMESTER - IV						
19PG4Z16	Environmental Biology	6	5	40	60	100
19PG4Z17	Biotechnology	6	5	40	60	100
19PG4Z18	Developmental Biology	6	5	40	60	100
19PG4ZE3/ 19PG4ZE4	Economic Zoology/ Ethology	4	4	40	60	100
19PG4Z19	Lab in Environmental Biology & Developmental Biology	4	2	40	60	100
19PG4Z20	Lab in Biotechnology, Economic Zoology& Ethology	4	2	40	60	100
19PG4Z21	Project*& Viva Voce		3	50	50	100
Total		**30**	**26**			
	Total	**120**	**90**			

OFF-CLASS PROGRAMME

ADD-ON COURSES

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
	SOFT SKILLS	40	4	I	40	60	100
	COMPUTER APPLICATIONS ● Computer Application for Biologists ● SPSS	40	4	II	40	60	100
	MOOC COURSES (Department Specific Courses) * Students can opt other than the listed	-	Minimum 2 Credits	-	-	-	

	course from UGC-SWAYAM /UGC /CEC						
	COMPREHENSIVE VIVA (Question bank to be prepared for all the papers by the respective course teachers)	-	2	IV	-	-	100
	READING CULTURE	15/ Semester	1	I-IV	-	-	-
	TOTAL		13 +				

EXTRA CREDIT COURSE

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
19PGSLZ1	**Vector Borne Diseases (Offered for II PG)**	-	-	III & IV	40	60	100

II M.Sc.,ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3Z13	Biostatistics & Research Methodology	PG Core	6 Hrs.	5

COURSE DESCRIPTION

This course deals with specific procedures or techniques used to identify and process the research data.

COURSE OBJECTIVES

- Identify the research problem and generation of raw data through different methods.
- Apply the statistical tools to calculate and tabulate the data.
- Interpret the results and draw conclusion.
- Outline the steps in drafting the thesis.

UNITS

UNIT –I INTRODUCTION TO BIOSTATISTICS (18 HRS.)

Introduction, Definitions, Types of biological data, Sampling – types, samples from populations, graphical frequency distribution and graphical representation of data. Measures of central tendency - Mean, Median, and Mode. Dispersion & variability – the range and the mean deviation, the variance, standard deviation, the coefficient of variance, standard error.

Self – study - Introduction, Definitions, Types of biological data, Sampling – types, samples from populations, graphical frequency distribution and graphical representation of data.

UNIT -II DISTRIBUTION AND TESTING OF HYPOTHESIS (18 HRS.)

The normal distribution- skewness & kurtosis, proportions of a normal curve – Z scores - Testing of hypothesis - Importance & types – Chi – square test –

comparison of means of two large samples, means of two small samples, paired & unpaired t tests.

UNIT -III CORRELATION& REGRESSION (18 HRS.)

Correlation analysis-Kinds, Degree - Types of correlation- Pearson's Correlation Coefficient -Regression analysis- Simple, linear regression, testing the significance of regression. The analysis of variance - Single factor ANOVA – basic assumptions under ANOVA, One Way and Two Way ANOVA.

UNIT -IV INTRODUCTION TO RESEARCH & RESEARCH DESIGN

(18 HRS.)

Research: Definition, Importance, Meaning of research –Characteristics of research –Types of Research – Research approaches (Qualitative and Quantitative)- significance of research. Research problem: Identification, Selection and formulation of research problem –Research design: Features and concepts -Dependent and independent variables, research hypothesis – Types.

Self – study- Research report-components, tables, figures, formatting and typing

UNIT –V THESIS WRITING (18HRS.)

Preparation and Writing of Thesis: Components of thesis – Literature collection - Literature citation- Research report-components, tables, figures, formatting and typing. Preparing of scientific papers for publication to a Journal and presenting in symposia/seminar, Plagiarism - Types.

Self – study- Research report-components, tables, figures, formatting and typing

TEXT BOOK:

Ramakrishnan P., (2010). Biostatistics, Saras publication, Nagercoil, Tamil Nadu.

REFERENCES:

1. Kothari. C.R., (2009). *Research Methodology*, New Age International,

2. Khan and Khanum., (2004).*Fundamentals & Biostatistics*, 2nd ed., Ukaaz Publications, Hyderabad.
3. Gurumani N., (2010). *An Introduction to Biostatistics*, MJP Publishers, Chennai.
4. Satguru Prasad., (2012). *Elements of Biostatistics,* Rastogi publications, Meerut.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. http://www.oercommons.org/courses/biostatistics-methods-2/view
2. https://www.oercommons.org/courses/chi-square-test-08-54
3. https://www.oercommons.org/courses/anova-calculations
4. https://www.oercommons.org/authoring/21429-wp-12-1-additional-test-of-two-population-variance/view
5. https://vivaopen.oercommons.org/courseware/unit/420

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO BIOSTATISTICS				
1.1	Introduction, Definitions, Types of biological data	2	Chalk & Talk	Black Board
1.2	Sampling – types, samples from populations	3	Chalk & Talk	LCD
1.3	Graphical frequency distribution and graphical representation of data	3	Lecture	PPT & White board

1.4	Measures of central tendency - Mean, Median, and Mode.	4	Lecture	Black Board
1.5	Dispersion & variability – the range and the mean deviation, the variance	3	Lecture	Black Board
1.6	Standard deviation, the coefficient of variance, standard error.	3	Lecture	Black Board
UNIT -2 DISTRIBUTION AND TESTING OF HYPOTHESIS				
2.1	The normal distribution-skewness & kurtosis, proportions of a normal curve – Z scores	4	Lecture	Black Board
2.2	Testing of hypothesis - Importance & types	3	Chalk & Talk	Black Board
2.3	Chi – square test	3	Chalk & Talk	Black Board
2.4	Comparison of means of two large samples, means of two small samples	5	Chalk & Talk	Black Board
2.5	Paired & unpaired t tests	3	Lecture	White board
UNIT -III CORRELATION & REGRESSION				
3.1	Correlation analysis-Kinds, Degree - Types of correlation-Pearson's Correlation Coefficient	4	Chalk & Talk	Black Board
3.2	Regression analysis- Simple, linear regression, testing the significance of regression.	5	Chalk & Talk	Black Board
3.3	The analysis of variance - Single factor ANOVA – basic assumptions under ANOVA	5	Lecture	White board
3.4	One Way and Two Way ANOVA	4	Lecture	Black Board

TITLE-IV INTRODUCTION TO RESEARCH & RESEARCH DESIGN				
4.1	**Research: Definition, Importance, Meaning of research**	4	Chalk & Talk	Black Board
4.2	Characteristics of research – Types of Research – Research approaches (Qualitative and Quantitative)- significance of research.	4	Chalk & Talk	Black Board
4.3	Research problem: Identification, Selection and formulation of research problem	4	Lecture	White board
4.4	Research design: Features and concepts -Dependent and independent variables	4	Lecture	Black Board
4.5	Research hypothesis – Types	2	Lecture	Black Board
UNIT –V THESIS WRITING				
5.1	Preparation and Writing of Thesis	2	Chalk & Talk	Black Board
5.2	Components of thesis	2	Chalk & Talk	Black Board
5.3	Literature collection - Literature citation	3	Lecture	White board
5.4	**Research report-components, tables, figures, formatting and typing.**	4	Lecture	Black Board

5.5	Preparing of scientific papers for publication to a Journal and presenting in symposia/seminar	4	Lecture	Black Board
5.6	Plagiarism – Types	3	Lecture	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better of W1, W2 5Mks.	M1+M2 10 Mks	MID-SEM TEST 15 Mks	35 Mks.	5 Mks.	40Mks.	
K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %
K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Organise the research data in appropriate order and apply the measures of central tendency and dispersion values.	K3	PSO3
CO 2	Assess the difference between the expected and observed frequencies	K5	PSO2

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	by Chi-Square test for testing of hypothesis		
CO 3	Compute degrees of relationship variables using Correlation and Regression analysis.	K3	PSO 11
CO 4	Examine the Concepts of Research and devise the Research Hypothesis.	K4	PSO 7 & PSO8
CO 5	Parapharse the research work through documentation as a Thesis, Oral or Poster Presentation.	K2	PSO 5

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	-	-	**3**	-	-	-	-	-	-	-	-	-
CO2	-	**2**	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	**3**	-	-	-	-	-	-	-
CO4	**3**	-	**3**	-		-	**2**	-	-	-	-	-
CO5	-	-	-	-	**3**	-	-	-	-	-	-	-

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	-	3	-	-	3
CO2	-	3	-	-	3
CO3	-	3	-	-	3
CO4	-	3	-	-	3
CO5	-	3	-	-	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:
Dr. X. Devanya Rosaline

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HOD'S Signature & Name

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PGSZO	19PG3Z14	Lab in Biophysics & Biostatistics	Practical	4 Hrs.	2

COURSE DESCRIPTION

The course is designed to give a hand on experience in Biophysics and biostatistics

COURSE OBJECTIVES

On completion of the course, students should be able to develop skill in performing experiments, analysis and interpretation of the result.

BIOPHYSICS

1. pH Meter: Standardization of pH meter, Preparation of Buffers.
2. pH titration curve of acid-base
3. Osmolarity: Determination of osmotic pressure of salts.
4. To study the characteristics of absorption spectra of Aromatic Amino Acids.
5. To study the characteristics of absorption spectra of Proteins
6. Colorimeter: Verification of Beer's Lambert law, determination of absorption maxima of coloured compounds, and molar extinction coefficient.
7. Estimation of percent purities of dyes and inorganic compound
8. Centrifuge – Principle and techniques.
9. Separation of aminoacid mixture using paper chromatography
10. Surface tension by drop weight method
11. Comparison of Viscosity of two liquids

BIOSTATISTICS

1. Collection of data and representation - histogram, curves and pie diagrams.
2. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation - individual observation
3. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation – continuous series.
4. Calculation of correlation coefficient – width/diameter of shell.
5. Calculation of correlation coefficient – height and weight of students in the class.
6. Calculation of regression co-efficient using length and width of leaves.
7. Probability experiment with coin tossing (one coin, two coins). using chi square test
8. Test of significance for small samples – student's t test.

REFERENCES:

1. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences,*Anjana Book House, Chennai.
2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.*
3. Tembhare D.B., (2008) *Techniques in Life Sciences, 1st ed.*, Himalaya Publishing House Pvt. Ltd., Mumbai.
4. Dutta A., (2009*) Experimental Biology Lab manual*, Narosa Publishing House, New Delhi.
5. Palanivelu P., (2004) *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students, 3rd ed.*, Kalaimani Printers, Madurai.
6. Wilson K and Walker J., (2013) *Principles and Techniques of Biochemistry and Molecular Biology, 7th ed.,* Cambridge University Press, New York.
7. Roe S., (2001) *Protein Purification Techniques – A Practical Approach, 2nd* ed., Oxford University Press.
8. Boyer R., (2000) *Modern Experimental Biochemistry, 3rd ed.,* Pearson Education Inc.
9. Wilson K and Kenneth H.G., (1992) *A Biologists Guide to Principles and Techniques of Practical Biochemistry, 3rd ed.*, Cambridge University Press, Cambridge, UK.

10. Khan I.A and Khanum A., (2004) *Fundamentals & Biostatistics, 2nd ed.*, Ukaaz Publications, Hyderabad.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://vlab.amrita.edu/index.php?sub=3&brch=258
2. https://bms.ucsf.edu/resources-learning-biostatistics
3. https://nextgenu.org/mod/url/view.php?id=31720
4. https://instr.iastate.libguides.com/oer/stats
5. https://www.biophysics.org/education-careers/education-resources/additional-education-resources

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOPHYSICS				
1	pH Meter: Standardization of pH meter, Preparation of Buffers.	4	Chalk & Talk	pH meter
2	pH titration curve of acid-base	4	Hands on training	pH meter
3	Determination of osmotic pressure of salts.	4	Hands on training	sample
4	Absorption spectra of Aromatic Amino Acids.	4	Hands on training	Colorimeter
5	characteristics of absorption spectra of Proteins	4	Hands on training	Colorimeter
6	Colorimeter: Verification of Beer's Lambert law, determination of absorption maxima of coloured compounds, and	4	Chalk & Talk	Colorimeter

	molar extinction coefficient.			
7	Estimation of percent purities of dyes and inorganic compound	4	Hands on training	colorimeter
8	Centrifuge – Principle and techniques.	4	Chalk & Talk	centrifuge
9	Separation of amino acid mixture using paper chromatography	4	Hands on training	Filter paper
10	Surface tension by drop weight method	4	Hands on training	Instrument
BIOSTATISTICS				
11	Collection of data and representation - histogram, curves and pie diagrams.	4	Lecture	Green Board
12	Measures of Central tendency – individual observation	4	Hands on training	Leaves/Shell
13	Measures of Central tendency – continuous series	4	Hands on training	Leaves/Shell
14	Calculation of correlation coefficient – width/diameter of shell	4	Hands on training	Leaves/Shell
15	Calculation of correlation coefficient – height and weight of students in the class.	4	Hands on training	Meter scale/Weighing machine
16	Calculation of regression co-efficient using length and width of leaves/Shell	4	Hands on training	Leaves/Shell
17	Probability experiment with coin tossing (one coin, two coins). using chi square test	4	Hands on taining	Coin

18	Test of significance for small samples – student's t test.	4	Chalk & Talk	Green Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better of W1, W2 5Mks.	M1+M2 10 Mks	MID-SEM TEST 15 Mks	35 Mks.	5 Mks.	40Mks.	
K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %
K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Recall the principle of centrifuge, pH meter, Chromatography	K1	PSO1, PSO3, PSO5
CO 2	Determine the maximum absorption and its molar extinction coefficient of sample	K5	PSO3, PSO5
CO 3	Estimate the pH Titration curve, Surface tension and viscosity of sample	K5 & K6	PSO3

CO 4	Interpret the results for statistical analysis including mean, median, mode and Standard deviation for individual, continuous series	K2 & K5	PSO3&PSO7 &PSO11
CO 5	Determine the correlation, regression and significance for the statistical data	K5	PSO3 & PSO5, PSO11

Mapping of C0s with PSOs

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**PSO 9**	**PSO 10**	**PSO 11**	**PSO 12**
CO1	**2**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**-**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**-**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	2	3	3	2	2
CO3	2	3	3	2	2
CO4	1	3	3	1	1
CO5	1	3	3	1	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. N. Nagarani

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HOD'S Signature & Name

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PGSZO	**19PG3Z15**	**Lab in Immunology, Fisheries & Aquaculture and Bioinformatics**	**Major Practical**	**40 Hrs.**	**2**

COURSE DESCRIPTION

It focuses on techniques related to the field of immunology. It includes preparation of antigens and to visualize precipitin and agglutination

COURSE OBJECTIVES

To perform hemoagglutination, single immunodiffusion, double immunodiffusion, and also to be familiarized with the principle of ELISA, immunoelectrophoresis, rocket immunoelectrophoresis.

EXPERIMENTS

1. Laboratory safety guidelines and Animal ethics
2. Lymphoid organs – Thymus (Chick), Spleen (Goat)
3. Separation of serum & plasma
4. Total Leukocyte Count (TLC)
5. Separation of lymphocytes from peripheral blood
6. Isolation of splenocytes from goat
7. Antigen preparation and immunization
8. Isolation of serum immunoglobulins
9. Haemagglutination titration
10. Immunodiffusion techniques – single and double immunodiffusion

11. Immunoelectrophoresis- Demonstration
12. Rocket Immunoelectrophoresis- Demonstration
13. Complement mediated hemolysis
14. Spotters: ELISA
15. Biological databases – NCBI
16. Sequence analysis – BLAST, ClustalO
17. Field visit to aquarium

REFERENCES:

1. Sinha, J, Chatterjee, A.K, Chatoopadhya, P. (2015). *Advanced practical Zoology*, 4th Edition, Books and Allied, (P) Ltd.
2. Dutta A. (2009). *Experimental Biology A laboratory Manual*, Narosa Publishing House, New Delhi.
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4. Tembhare, DB. (2008). *Techniques in Life Sciences*, 1st Edition, Himalaya Publishing House.
5. Rao, CV. (2007). *A text book of Immunology*, 3rd edition, Narosa Publishing House, New Delhi.
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DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://pubmed.ncbi.nlm.nih.gov/30426422/
2. https://www.nature.com/articles/nrrheum.2017.125
3. www.ncbi.nlm.nih.gov
4. www.ncbi.nlm.nih.gov/blast/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**TITLE**			
1.1	Laboratory safety guidelines and Animal ethics	1	Lecture	Blackboard
1.2	Lymphoid organs – Thymus (Chick), Spleen (Goat)	1	Demonstration	Specimen
1.3	Separation of serum & plasma	4	Hands on training	Specimen
1.4	Total Leukocyte Count (TLC)	1	Hands on training	Specimen
1.5	Separation of lymphocytes from peripheral blood	1	Hands on training	Specimen
1.6	Isolation of splenocytes from goat	1	Hands on training	Specimen
1.7	Antigen preparation and immunization	2	Hands on training	Tissue sample
1.8	Isolation of serum immunoglobulins	1	Lecture & Demonstration	Blackboard & Specimen
1.9	Haemagglutination titration		Hands on training	Kit
1.10	Immunodiffusion techniques – single and double immunodiffusion		Hands on training	Kit
1.11	Immunoelectrophoresis-Demonstration		Hands on training	Kit
1.12	Rocket Immunoelectrophoresis-Demonstration		Hands on training	Kit

1.13	Complement mediated hemolysis		Hands on training	Kit
1.14	Spotters: ELISA		Observation	Diagram
1.15	Biological databases – NCBI		Hands on training	Online software
1.16	Sequence analysis – BLAST, ClustalO		Hands on training	Online software
1.17	Field visit to aquarium		On the spot study	-

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better of W1, W2 5Mks.	M1+M2 10 Mks	MID-SEM TEST 15 Mks	35 Mks.	5 Mks.	40Mks.	
K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %
K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

The best out of two will be taken into account

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain the different lymphoid organs, properties of soluble and particulate antigen	K2	PSO1, PSO2, & PSO3
CO 2	Estimate the lymphocytes from peripheral blood and explain the biological databases NCBI	K2	PSO2 & PSO3
CO 3	Construct various bleeding techniques and separation of serum and plasma and plan a visit to aquarium.	K3	PSO3
CO 4	Examine the experiment with complement mediated lysis, Immunoelectrophoresis and rocket immunoelectrophoresis identification and single / double immunodiffusion	K4	PSO2 & PSO3
CO 5	Analyze the sequences BLAST AND ClustalO and Assess the formation of perciptin line and button formation	K5	PSO2 & PSO3

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	3	-	3	-	-	-	-	-	3	-
CO2	3	-	3	-	3	-	-	-	-	-	-	-
CO3	3	2	2	-	3	-	-	-	-	-	3	-
CO4	3	3	3	-	3	-	-	-	-	-	3	-
CO5	3	2	3	-	3	-	-	-	-	-	3	-

Mapping of C0s with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	-	3
CO2	3	3	2	-	3
CO3	3	3	2	-	3
CO4	3	3	3	-	3
CO5	3	3	3	-	3

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. J. Asnet Mary

Forwarded By

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HOD'S Signature & Name

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4ZE3	Economic Zoology	Lecture	4	4

COURSE DESCRIPTION

The course has great potential for creating self-employment and business opportunity

COURSE OBJECTIVES

- Enable the students to be familiarized with bee keeping, prawn culture, pearl culture, poultry and dairy farming to become an entrepreneur.
- Understand the medicinal value of honey.
- Know to manage and maintain poultry farms.

UNITS

UNIT –I APICULTURE (12 HRS.)

Scope of Apiculture - Morphology of honey bees –species of honey bees: *Apis dorsata*, *Apis indica*, *Apis florea*, *Apis mellifera*– social behaviour of honey bees – Bee keeping: Newton's Bee hive -Extraction of honey – Medicinal value of honey – bee products – Importance of bee colonies in crop pollination.

Self-study – Scope of Apiculture -Social behaviour of honey bees – Bee keeping: Newton's Bee hive -Extraction of honey – Medicinal value of honey – bee products.

UNIT –II SERICULTURE (12 HRS.)

Sericulture in India –silk route - Role of Central Silk Board - Different silkworm species and their host plants – Life cycle of Mulberry silkworm - silkworm rearing: Rearing appliances and Rearing methods–cocoon marketing – raw silk testing – silk waste – economic importance of silk.

Self-study – silk route- Economic importance of silk

UNIT –III PRAWN AND PEARL CULTURE (12 HRS.)

Prawn culture: Types of prawn culture – Culture of fresh water prawn – Culture of marine prawn – Preparation of farm - Preservation and processing of prawn- Export of prawn.

Pearl culture: Types of pearl - Oysters and pearl formation - Composition, colour, size and quality of pearl – culture of pearls.

UNIT –IV POULTRY FARMING (12 HRS.)

Breeds of chick - Housing and Equipment: Deep litter System - Laying cages - Methods of brooding and Rearing –Debeaking - Management of growers, Layers, Broilers – Feed formulations for chicks, Growers and Broilers – vaccination schedule - Nutritive value of egg and meat.

Self-study – Nutritive value of egg and meat

UNIT –V DAIRY FARMING (12 HRS.)

Indigenous and exotic breeds - Rearing – housing – feed and rationing– Commercial importance of dairy farming- Pasteurization of milk – milk products – nutritive value of milk.

Self-study – Pasteurization of milk

REFERENCES:

1. Vasantharaj David, B. and Kumaraswami T., 1998. *Elements of Economic Entomology* Pop. Book Depot. Chennai.
2. Ganga and Sulochana Shetty J.G. (2005)*An introduction to sericulture,* second edition, Oxford & IBH Publishing & Co. Pvt. Ltd., New Delhi.
3. Reddy, S. G., (1994)*Silkworm Breeding*, Oxford & INH Publishing Co Pv Ltd., New Delhi.

4. Boraiah, G. (1994) *Lectures on Sericulture*, SBS Publishers distributors, Bangalore.
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6. Jhingran,V.G.,(1975) *Fish and Fisheries of India*, Hindustan publishing corporation, India.
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8. Uma Shankar Singh, (2008) *DairyFarming*,Anmol Publications, New Delhi.
9. ICAR, *Hand book of Animal Husbandry*, The Indian Council for Agricultural Research, New Delhi.
10. N. Nagaraja and D.Rajagopal, (2009).*Honey Bees- Diseases, Parasites, Pests, Predators & their management,* MJP Publishers, Chennai.
11.R. C. Mishra, (1998) *Perspectives in Indian Apiculture,* Agro Botanica, New Delhi.

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2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4632584/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2748269/
4. https://www.ncbi.nlm.nih.gov/books/NBK232334/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5794767/
6.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**APICULTURE**			
1.1	Morphology of honey bees	3	Chalk & Talk	Black Board

1.2	species of honey bees: *Apis dorsata*,	3	Chalk & Talk	LCD
1.3	*Apis indica*, *Apis florea*, *Apis mellifera*	3	Lecture	PPT
1.4	Importance of bee colonies in crop pollination.	3	Lecture	LCD
1.5	**Self-study – Scope of Apiculture - Social behaviour of honey bees – Bee keeping: Newton's Bee hive -Extraction of honey – Medicinal value of honey – bee products**.		Discussion	
UNIT -2 SERICULTURE				
2.1	Sericulture in India –silk route - Role of Central Silk Board	2	Chalk & Talk	Black Board
2.2	Different silkworm species and their host plants	2	Chalk & Talk	Black Board
2.3	Life cycle of Mulberry silkworm	2	Chalk & Talk	LCD
2.4	silkworm rearing: Rearing appliances and Rearing methods	3	Chalk & Talk	Black Board
2.5	cocoon marketing – raw silk testing – silk waste	3	Lecture	Black Board
2.6	**Self-study – Silk route - Economic importance of silk**		Discussion	
UNIT -3 PRAWN AND PEARL CULTURE				

3.1	Prawn culture: Types of prawn culture	1	Chalk & Talk	Black Board
3.2	Culture of fresh water prawn	1	Lecture	Black Board
3.3	Culture of marine prawn	1	Lecture	Black Board
3.4	Preparation of farm	1	Chalk & Talk	Black Board
3.5	Preservation and processing of prawn- Export of prawn.	2	Lecture	Black Board
3.6	Pearl culture: Types of pearl	1	Chalk & Talk	Black Board
3.7	Oysters and pearl formation	2	Chalk & Talk	Black Board
3.8	Composition, colour, size and quality of pearl	2	Chalk & Talk	Black Board
3.9	culture of pearls	1	Chalk & Talk	LCD
UNIT -4 POULTRY FARMING				
4.1	Breeds of chick	2	Chalk & Talk	LCD
4.2	Housing and Equipment	2	Chalk & Talk	Black Board
4.3	Deep litter System	2	Chalk & Talk	Black Board
4.4	Laying cages - Methods of brooding and Rearing	2	Chalk & Talk	Black Board
4.5	Debeaking - Management of growers, Layers, Broilers - vaccination schedule	2	Chalk & Talk	Black Board

4.6	Feed formulations for chicks, Growers and Broilers	2	Chalk & Talk	PPT
4.7	**Self-study – Nutritive value of egg and meat**		Discussion	
UNIT -5 DAIRY FARMING				
5.1	Indigenous and exotic breeds	3	Lecture	LCD
5.2	Rearing – housing	3	Chalk & Talk	Black Board
5.3	Feed and rationing	2	Chalk &Talk	Black Board
5.4	Commercial importance of dairy farming	2	Chalk & Talk	Black Board
5.5	milk products - nutritive value of milk	2	Lecture	PPT
5.6	**Self-study – Pasteurization of milk**		Discussion	

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better of W1, W2 5Mks.	M1+M2 10 Mks	MID - SEM TEST 15 Mks	35 Mks.	5 Mks.	40Mks.	
K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %

K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

The best out of two will be taken into account

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Compare the morphological adaptation in bees in relation to their social behaviour.	**K2**	PSO2
CO 2	Plan for a sericulture unit as a cottage industry.	**K3**	PSO4& PSO10
CO 3	Analyse the rearing methods of prawn and pearl oysters.	**K4**	PSO10
CO 4	Summarize the rearing methods of chick.	**K2**	PSO2
CO 5	Assess the commercial importance of dairy farm	**K5**	PSO10

Mapping of COs with PSOs

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	-	3	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	2	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	3	-	-	-	-
CO2	3	-	-	-	-
CO3	2	3	-	-	-
CO4	3	-	-	-	-
CO5	-	3	-	-	-

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:
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II M.Sc.,ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4ZE4	Ethology	Lecture	4 Hrs.	4

COURSE DESCRIPTION

Students gain knowledge on learning, behaviour and biorhythm in animal.

COURSE OBJECTIVES

- Acquire fundamental knowledge on the behavioural concept in animals
- Understand the environment, social and reproductive behaviour in animals
- Summarize the phenomenon behind the molecular basis of biological rhythm including circadian.

UNIT –I INTRODUCTION TO ETHOLOGY (12 HRS.)

Introduction -Ethology and Animal psychology. Classification of behavioral patterns: Analysis of behaviour (ethogram) **-** Reflexes and complex behaviour. Perception of the Environment: Mechanical, Electrical, Chemical, Olfactory, Auditory and Visual. Neural and Hormonal Control of behaviour; Role of nervous system in mergence of behavioural patterns; Role of endocrine secretions in behavioural expressions. Genetic and environmental components in the development of behaviour.

Self - study - Introduction to Ethology and Animal psychology. Perception of the Environment: Mechanical, Electrical, Chemical, Olfactory, Auditory and Visual.

UNIT –II COMMUNICATION AND LEARNING (12 HRS.)

Communication: Importance – types - components and evolution of communication. Role of Visual & auditory systems, hormones & pheromones in communication.Language of communication - invertebrates and vertebrates. Learning and instincts: conditioning, habituation, sensitization, reasoning. Innate releasing mechanisms: key stimuli, stimulus filtering, supernormal stimuli, open and closed IRM, mimetic releaser, code breakers.

Self - study - Communication: Importance

UNIT –III REPRODUCTION AND SOCIAL BEHAVIOUR (12 HRS.)

Reproductive Behavior: Evolution of sex and reproductive strategies, Mating systems, courtship. Sexual selection: intra sexual selection (male rivalry), inter-sexual selection (female choice), infanticide, sperm competition, mate guarding, sexual selection in human, consequences of mate choice for female fitness, monogamous verses polygamous sexual conflict. Social Behavior: Aggregations – Schooling in fishes, flocking in birds, herding in mammals - group selection, kin selection. Altruism – reciprocal altruism, group selection, kin selection and inclusive fitness, cooperation, alarm call. Social organization in insects.Parental Care in Primates.

Self - study – Primates - Parental care.

UNIT –IV ECOLOGICAL BEHAVIOUR (12 HRS.)

Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defenses, aggression, homing, territoriality, dispersal, host parasite relations.

Homeostasis and behaviour: motivational system, physiological basis of motivation, control of hunger drive in blow fly and thirst drive in goat, role of hormone, motivational conflict and decision making, displacement activity, models of motivation, measuring motivation. Hormones and pheromones influence on behaviour of animals.

UNIT –V CIRCADIUM RHYTHM (12 HRS.)

Biological Rhythms: Circadian and Circannual rhythms, Orientation and navigation: Migration of fish and birds. Molecular Genetics of Circadian Rhythms- the regulation of biological clock-sleep and awake in man.Sleeping

disorders - medical diagnosis and therapy. Chronopharmacology, Chronomedicine, Chronotherapy.

Self study – Migration of fish and birds

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (HRS.)

REFERENCES:

1. Agarwal V.K. (2010). *Animal Behaviour* (Ethology). S. Chand Publishers.
2. Insect Clocks D.S., Saunders C.G.H., Steel X., Afopoulou (ed.) R.D. Lewis. (3rd Ed) 2002 Barens and Noble Inc. New York, USA.
3. Vinod Kumar (2002). *Biological Rhythms* .Narosa Publishing House, Delhi/ Springer-Verlag, Germany
4. Jay C. D., Jennifer J., Loros, Patricia J. DeCoursey (ed). (2004). *ChronobiologyBiological Timekeeping*: Sinauer Associates, Inc.Publishers, Sunderland, MA, USA
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1. https://www.oercommons.org/authoring/2459-conditioning-animals-learning-behaviour-ecology-en/view
2. https://www.oercommons.org/browse?f.keyword=animal-behaviour
3. https://www.psychologytoday.com/intl/basics/animal-behavior
4. https://seaworld.org/animals/all-about/training/animal-behavior-and-learning/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO ETHOLOGY				
1.1	**Introduction -Ethology and Animal psychology.**	1	Chalk & Talk	Black Board
1.2	Classification of behavioral patterns	2	Chalk & Talk	LCD
1.3	Analysis of behaviour (ethogram) - Reflexes and complex behaviour.	2	Lecture	PPT & White board
1.4	**Self Study: Perception of the Environment: Mechanical, Electrical, Chemical, Olfactory, Auditory and Visual.**	-	Discussion	LCD
1.5	Neural and Hormonal Control of behaviour; Role of nervous system in mergence of behavioural patterns;	3	Lecture	Black Board
1.6	Role of endocrine secretions in behavioural expressions.	2	Chalk & Talk	Black Board
1.7	Genetic components in the development of behaviour	1	Lecture	PPT & White board
1.8	Environmental components in the development of behaviour.	1	Discussion	Black Board
UNIT -2 COMMUNICATION AND LEARNING				

2.1	Communication: Importance – types - components and evolution of communication.	1	Lecture	Green Board Charts
2.2	Role of Visual & auditory systems in communication.	2	Chalk & Talk	Green Board
2.3	Role of hormones & pheromones in communication	2	Chalk & Talk	Black Board
2.4	**Topic**: Language of communication	1	Chalk & Talk	Black Board
2.5	**Sub topics:** Invertebrates and vertebrates.	2	Lecture	PPT & White board
2.6	Learning and instincts: conditioning, habituation, sensitization, reasoning.	2	Lecture	Green Board
2.7	**Topic: Innate releasing mechanisms**	1	Chalk & Talk	Green Board
2.8	**Sub topics:** key stimuli, stimulus filtering, supernormal stimuli, open and closed IRM, mimetic releaser, code breakers.	2	Chalk & Talk	Black Board
UNIT -3 REPRODUCTION AND SOCIAL BEHAVIOUR				
3.1	Reproductive Behavior:	1	Chalk & Talk	Black Board
3.2	Evolution of sex and reproductive strategies, Mating systems, courtship		Chalk & Talk	Black Board
3.3	Sexual selection: intra sexual selection (male rivalry), inter-sexual selection (female choice), infanticide, sperm competition, mate guarding, sexual selection in human, consequences of		Lecture	PPT & White board

	mate choice for female fitness, monogamous verses polygamous sexual conflict.			
3.4	Social Behavior: Aggregations – Schooling in fishes, flocking in birds, herding in mammals – group selection, kin selection.		Lecture	PPT
3.5	Altruism – reciprocal altruism, group selection, kin selection and inclusive fitness, cooperation, alarm call.		Chalk & Talk	Black Board
3.6	Social organization in insects.		Lecture	Group Discussion
3.7	**Self – study – Primates – Parental care.**		Lecture	PPT & White board
UNIT – 4 ECOLOGICAL BEHAVIOUR				
4.1	Ecological aspects of behaviour	1	Lecture	PPT & White board
4.2	**Sub topics:** Habitat selection, food selection, optimal foraging theory,	2	Chalk & Talk	LCD
4.3	**Sub topics**: anti-predator defenses, aggression, homing, territoriality, dispersal, host parasite relations.	2	Chalk & Talk	Black Board
4.4	Homeostasis and behaviour	1	Chalk & Talk	Black Board
4.5	**Sub topics:** motivational system, physiological basis of motivation, control of hunger	4	Chalk & Talk	PPT

	drive in blow fly and thirst drive in goat, role of hormone, motivational conflict and decision making, displacement activity, models of motivation, measuring motivation.			
4.6	Hormones and pheromones influence on behaviour of animals.	2	Chalk & Talk	LCD
UNIT -5 CIRCADIUM RHYTHM				
5.1	Biological Rhythms: introduction	1	Chalk & Talk	Black Board
5.2	Circadian and Circannual rhythms,	2	Chalk & Talk	LCD
5.3	Orientation and navigation: **Migration of fish and birds.**	1	Discussion	Black Board
5.4	Molecular Genetics of Circadian Rhythms- the regulation of biological clock-sleep and awake in man.	4	Lecture	PPT & White board
5.5	Sleeping disorders - medical diagnosis and therapy	2	Lecture	PPT & White board
5.6	Chronopharmacology, Chronomedicine, Chronotherapy.	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better of W1, W2 5Mks.	M1+M2 10Mks	MID-SEM TEST 15 Mks	35 Mks.	5 Mks.	40Mks.	
K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %
K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

Nos					
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

The best out of two will be taken into account

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Classify different patterns of genetic, environmental, neural and hormonal animal behaviour	**K4**	PSO2, PSO4 & PSO5, PSO11
CO 2	Explains the role of visual, auditory communication with respect to learning and instincts mechanism	**K5**	PSO2, PSO5 & PSO11
CO 3	Discuss the various reproductive and social behaviours in context to pair selection.	**K6**	PSO2, PSO5 & PSO11
CO 4	Summarizes the ecological condition such as hunger, thirst, territories etc., in influencing the animal behaviour.	**K2**	PSO2, PSO4 PSO5, PSO8, PSO11
CO 5	Elaborate the molecular regulation of circadian rhythm	**K6**	PSO1, PSO2, PSO5 & PSO11

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	-	3	-	1	3	-	-	-	-	-	3	-
CO2	-	3	-	-	3	-	-	-	-	-	3	-
CO3	-	3	-	-	3	-	-	-	-	-	3	-
CO4	-	3	-	1	3	-	-	1	-	-	3	-
CO5	3	3	-	-	3	-	-	-	-	-	3	-

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	2	1
CO2	2	3	1	2	1
CO3	2	3	1	2	1
CO4	1	3	1	1	1
CO5	1	3	1	1	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. N. Nagarani

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II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4Z20	Lab In Biotechnology, Economic Zoology & Ethology	Practical	4	2

COURSE DESCRIPTION

This course provides rich knowledge in isolating DNA from different sources. It also helps to observe the behavioural pattern of selected animals.

COURSE OBJECTIVES

- Students acquire hands on experience in using lab equipment.
- Gain knowledge in tissue culture and micropropagation techniques.
- Enable the students to know about chasing behaviour in fish.

UNITS

Biotechnology

1. Biosafety guidelines
2. Plant tissue culture techniques: Preparation of MS media, callus formation.
3. Micropropagation techniques
4. Isolation of genomic DNA from goat liver
5. Isolation of plasmid DNA from bacteria
6. DNA estimation using diphenylamine method
7. Restriction enzymes digestion of DNA.
8. Separation of DNA using Agarose gel electrophoresis.

9. Demonstration of PCR techniques.
10. Elution of DNA from Gel

Economic zoology

11. Visit of silk farms and silk reeling weaving units in nearby areas and submission of the report.

12. Observation of larval stages of Prawn.

13. Newton's Bee hive.
14. Feeder

Ethology

15. A field study of foraging or trail making behaviour in ant species.
16. Study of nest building behaviour in birds.
17. Study of habitat selection in spiders.
18. Chasing behaviour in fish.

REFERENCES:

1. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015) *Advanced Practical Zoology, Books and Allied (P) Ltd., Calcutta.*
2. Rajan S., Christy, S.R., (2011) *Experimental procedures in Life Sciences, Anjana Book House, Chennai.*

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://www.youtube.com/watch?v=nr1tV_LuqJk
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3395714/
3. https://www.ncbi.nlm.nih.gov/probe/docs/techpcr/
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6617107/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4242575/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
Biotechnology				
1	Biosafety guidelines	4	Lecture	
2	Plant tissue culture techniques: Preparation of MS media, callus formation.	4	Demonstration & hands on training	Plant
3	Micropropagation techniques	4	Demonstration & hands on training	
4	Isolation of genomic DNA from goat liver	4	Demonstration & hands on training	Goat liver
5	Isolation of plasmid DNA from bacteria	4	Demonstration & hands on training	Bacterial culture
6	DNA estimation using diphenylamine method	4	Demonstration & hands on training	Isolated DNA
7	Restriction enzymes digestion of DNA.	4	Demonstration & hands on training	Isolated DNA
8	Separation of DNA using Agarose gel electrophoresis	4	Demonstration & hands on training	Isolated DNA
9	Demonstration of PCR techniques	4	Demonstration	
10	Elution of DNA from Gel	4	Demonstration & hands on training	Isolated DNA

Economic zoology				
11	Visit of silk farms and silk reeling weaving units in nearby areas and submission of the report.	4	Demonstration	
12	Observation of larval stages of Prawn	4	Demonstration	Slides
13	Newton's Bee hive.	4	Demonstration	Model
14	Feeder	4	Demonstration	Model
Ethology				
15	A field study of foraging or trail making behaviour in ant species	4	Demonstration	Nature Observation
16	Study of nest building behaviour in birds	4	Demonstration	Nature Observation
17	Study of habitat selection in spiders	4	Demonstration	Nature Observation
18	Chasing behaviour in fish	4	Demonstration	Nature Observation

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Seminar	**Better of W1, W2**	**M1+M2**	**MID-SEM TEST**				
	5 Mks.	**5Mks.**	**10 Mks**	**15 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	

K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %
K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks

C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Demonstrate the plant tissue culture technique.	K2	PSO3
CO 2	Experiment with DNA isolation	K3	PSO3
CO 3	Estimate DNA quantitatively	K5	PSO3
CO 4	Analyse Newton's bee hive	K6	PSO2
CO 5	Relate nest building in different birds	K1	PSO2

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	-	-	**3**	-	-	-	-	-	-	-	-	-
CO2	-	-	**3**	-	-	-	-	-	-	-	-	-
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-
CO4	-	**3**	-	-	-	-	-	-	-	-	-	-
CO5	-	**3**	-	-	-	-	-	-	-	-	-	-

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	-	-	3	-	-
CO2	-	3	-	-	-
CO3	-	3	-	-	-
CO4	3	-	-	-	-
CO5	-	3	-	-	-

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr. S. Barathy**

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II M.Sc., ZOOLOGY

SEMESTER – IV

SELF-LEARNING PAPER

(For those who joined in 2019 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PGSLZ1	Vector Borne Diseases	Self Learning	-	2

COURSE DESCRIPTION

The course intends to provide the epidemiology, causes, symptoms, lifecycle of causative agent and prevention of various vector-borne diseases.

COURSE OBJECTIVES

- To understand the biology of vectors and host-vector interactions
- To envisage the environmental factors associated with disease prevalence.

UNITS

UNIT I – *AEDES* MOSQUITOES

Identification of *Aedes aegypti* and *Aedes albopictus* – epidemiology, Causes, transmission cycle - clinical symptoms, prevention and control measures of Chikungunya, Dengue fever, Yellow fever, Zika virus.

UNIT II – *ANOPHELES* AND *CULEX* MOSQUITOES

Epidemiology, Causes, clinical symptoms, life cycle of causative agent, prevention and control measures of Malaria, Japanese encephalitis, Lymphatic filariasis, West Nile fever.

UNIT III – OTHER VECTORS

Biology of Sandflies – Leishmaniasis – Biology of Ticks – Crimean-Congo haemorrhagic fever – Biology of Tsetse fly – African trypanosomiasis - Scrub Typhus – Leptospirosis.

UNIT IV - PREVENTION AND CONTROL

Long-lasting insecticidal nets – indoor residual spraying – outdoor spraying – Environmental management: Reduce breeding habitats – biological control, genetic control – Waste management – Housing modifications – personal protection – medication – prophylaxis and preventive therapies

UNIT V – ENVIRONMENTAL FACTORS

Deforestation - Agriculture and animal husbandry - Water control projects - Urbanization - Loss of biodiversity -. Introduction of alien species - Climate change - Anthropogenic factors driving climate change – Direct climate change effects – indirect climate change effects.

REFERENCES

1. A global brief on Vector-borne diseases (2014), WHO, WHO Press, World Health Organization, Geneva, Switzerland.
2. Vector Borne Diseases: Prevention, Treatment and control, Disease Prevention and Outbreak Response Cell (DPORC), Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi
3. Benelli, G. and Mehlhorn H. (2018) *Mosquito-borne Diseases Implications for Public Health*, Springer Nature Publications, USA.
4. Tyagi BK. (2019) *Vector-Borne Diseases: Epidemiology and Control* Scientific Publishers, India.
5. Institute of Medicine. 2008. Vector-Borne Diseases: Understanding the Environmental, Human Health, and Ecological Connections: Workshop Summary. Washington, DC: The National Academies Press.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER) :

1. https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases
2. http://publichealth.lacounty.gov/acd/vector.htm#:~:text=Vector%2DBorne%20Disease%3A%20Disease%20that,%2C%20Lyme%20disease%2C%20and%20malaria.
3. https://nvbdcp.gov.in/

4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4060056/
5. https://www.webmd.com/a-to-z-guides/zika-virus-symptoms-prevention
6. https://www.mosquito.org/page/lifecycle
7. https://www.healthline.com/health/leishmaniasis

EVALUATION PATTERN

Internal	External
Assignment – 20 Marks Test – 20Marks	Objective – 20 Marks Essay Type Qns. – 40 Marks
Total – 40Marks	Total – 60Marks

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe the biology and lifecycle of various vectors	**K1**	PSO1
CO 2	Discuss the genome and proteins of virus transmitted by vectors	**K2**	PSO1
CO 3	Relate the environmental factors that increase the prevalence of vector borne diseases	**K3**	PSO6, PSO7
CO 4	Summarize the various vector control methods and prevention of the disease	**K2**	PSO1
CO 5	Examine the anthropogenic factors that cause high incidence of vector-borne disease	**K1**	PSO6, PSO7

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	2	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	2	3	-	-	-	-	-

Mapping of C0s with POs

CO/ PSO	PO1	PO2	PO3	PO4	PO5
CO1	2	-	-	-	-
CO2	-	2	-	-	-
CO3	-	-	3	-	-
CO4	-	-	3	-	-
CO5	-	-	3	-	-

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

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