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

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF ZOOLOGY

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 and Bioinformatics	4	2	40	60	100
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	CIA Mks	ESE Mk	Total Marks

				the course is offered		**s**	
	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 course from UGC-SWAYAM /UGC /CEC	-	Minimum 2 Credits	-	-	-	
	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

- **Lab Courses :**
  - A range of 10-15 experiments per semester

- **Summer Internship:**
  - Duration-1 month (2nd Week of May to 2nd week of June-before college reopens)

- **Project:**
  - Off class
  - Evaluation components-Report writing + Viva Voce (Internal marks-50) + External marks 50

- **EDC:**

  Syllabus should be offered for two different batches of students from other than the parent department in Sem-I & Sem-II

I M.Sc.,(Zoology)

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG1Z1	Animal Diversity	PG Core.	6	4

COURSE DESCRIPTION

This course provides an overview of the Invertebrate and Vertebrate animals by focussing on the General characters, Classification, Special features and Biology of some selected Invertebrates and Vertebrates.

COURSE OBJECTIVES

- Acquire knowledge on general characters and classification of Invertebrates.
- Understand the levels of organization of symmetry and coelom of the Invertebrates.
- Gain knowledge on the taxonomic status of Invertebrates.
- Compare the organization and functional aspects of different systems of Vertebrates

UNITS

UNIT –I PROTOZOA& PORIFERA (18 HRS.)

Outline Classification of Animal Kingdom - Levels of Organization: Grades of Animal architecture- Symmetry - Coelom. General characters and Classification of Phyla: Protozoa and Porifera.General topics: Modes of Locomotion in Protozoa, Reproduction in Protozoa, Canal system in Sponges, Skeleton in Sponges and Origin of Metazoa.

Self-study –Outline Classification of Animal Kingdom - Levels of Organization: Grades of Animal architecture- Symmetry - Coelom.

UNIT –II COELENTERATA, HELMINTHES & ANNELIDA (18 HRS.)

General characters and Classification of Phyla: Coelenterata, Platyhelminthes, Aschelminthes and Annelida. General topics: Polymorphism in Hydrozoa, Corals and Coral Reefs, Helminthes and Human Diseases: Nematodiasis (Ascariasis, Ancylostomiasis, Trichurosis, Trichinosis, Strongyloidiasis, Filariasis, Loiasis, Onchocerciasis) - Trematodiasis (Schistosomiasis, Ophisthorchiasis, Paragonimiasis, Fasciolopsiasis and Fascioliasis) - Cestodiasis (Taeniasis and Echinococcosis) and Adaptive Radiation in Annelids.

Self-study –Corals and Coral Reefs

UNIT –III ARTHROPODA,MOLLUSCA& ECHINODERMATA(18 HRS.)

General characters and Classification of Phyla: Arthropoda, Mollusca and Echinodermata up to class level. General topics: Larval forms of Crustaceans, Cephalopods are highly evolved Molluscs, Torsion in Mollusca, Water vascular system in Echinoderms and Larval forms of Echinoderms.

Self-study –Cephalopods are highly evolved Molluscs

UNIT –IV PROCHORDATA & CHORDATA (18 HRS.)

General characters and Classification of Phylum – Chordata& Superclass Agnatha and Pisces, Class – Amphibia, Reptilia, Aves and Mammalia; Scales of Fishes; Economic Importance of Fishes; Neoteny and Paedogenesis; Adaptive radiation in Reptiles; Birds as Glorified Reptiles; Feet in Birds; Dentition in Mammals; Placentation in Mammals; Adaptive Convergence in Mammals.

Self-study –Economic Importance of Fishes

UNIT –V TYPE STUDY (18 HRS.)

Type Studies from the following: Phylum- Protozoa: *Paramecium*, Phylum- Porifera: *Leucosolenia*, Phylum- Coelenterata: *Obelia*, Phylum- Arthropoda- Prawn (*Penaeus*) and Phylum- Mollusca- *Lamellidens* (Freshwater Mussel). Class- Reptilia- *Calotes* and Class- Mammalia- Rabbit (*Oryctolaguscuniculus*).

REFERENCES:

1. Jordan E.L., and Verma P.S. (2001). *Invertebrate Zoology*, S.Chand& Co, New Delhi, 2001.
2. Kotpal R.L. (1998). *Modern Text Book of Zoology Invertebrates,* Rastogi Publications, Meerut, 1998.
3. Prasad S.N.(1989). *Invertebrate Zoology*, Vikas publishing House Pvt Ltd, India, 1989.
4. Ekambaranatha Ayyar M. and Ananthakrishnan T.N. (1981). *A manual of Zoology,* Part-II (Chordate), Viswanathan (Printers and Publishers) Pvt. Ltd, Chennai
5. Jordan E.L and Verma P.S (2006). *ChordateZoology*, S.Chand & Co Ltd, NewDelhi.
6. Prasad S.N. (2005). *Vertebrate Zoology*, KitabMahal Private Ltd , Allahabad-3.
7. Vishwanath (1967). *A Text Book of Zoology*, Volume II [Chordates] S.Chand& Co. Madras.
8. Newman. H.H (1987). *The Phylum Chordata*, Satish Book Enterprise, Motikala.
9. Young J.Z. (1962). *The Life of Vertebrates*. Oxford University Press, New York, ed. 2, 1962

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 PROTOZOA & PORIFERA				
1.1	General characters and Classification of Phyla: Protozoa	3	Chalk & Talk	Black Board
1.2	General characters and Classification of Phyla: Porifera	3	Chalk & Talk	LCD

1.3	Modes of Locomotion in Protozoa	3	Lecture	PPT
1.4	Reproduction in Protozoa	3	Lecture	Smart Board
1.5	Canal system in Sponges	3	Lecture	Black Board
1.6	Skeleton in Sponges and Origin of Metazoa	3	Chalk & Talk	Black Board
1.7	Self-study –Outline Classification of Animal Kingdom - Levels of Organization: Grades of Animal architecture- Symmetry - Coelom.		Discussion	
UNIT -2	**COELENTERATA, HELMINTHES &ANNELIDA**			
2.1	General characters and Classification of Phyla: Coelenterata, Platyhelminthes	2	Chalk & Talk	Black Board
2.2	General characters and Classification of Phyla: Aschelminthes andAnnelida.	2	Chalk & Talk	LCD
2.3	Polymorphism in Hydrozoa	2	Chalk & Talk	Black Board
2.4	Helminthes and Human Diseases: NematodiasisAscariasisAncylostomiasis, Trichurosis	3	Chalk &Talk	LCD
2.5	Trichinosis, Strongyloidiasis, Filariasis, Loiasis, Onchocerciasis	2	Chalk & Talk	Black Board
2.6	Trematodiasis, Schistosomiasis, Ophisthorchiasis, Paragonimiasis, Fasciolopsiasis and Fascioliasis)	3	Chalk & Talk	LCD
2.7	Cestodiasis (Taeniasis and Echinococcosis)	2	Chalk & Talk	Black Board
2.8	Adaptive Radiation in Annelids	2	Chalk & Talk	LCD
2.9	Self-study –Corals and Coral Reefs			
UNIT -3 ARTHROPODA,MOLLUSCA& ECHINODERMATA				
3.1	General characters and Classification of Phyla: Arthropoda	2	Lecture	PPT
3.2	General characters and Classification of Phyla: Mollusca	2	Lecture	PPT
3.3	General characters and Classification of Phyla: Echinodermata	2	Lecture	PPT & Videos
3.4	Larval forms of Crustaceans&Cephalopods are highly evolved Molluscs	2	Lecture	PPT & Videos
3.5	Torsion in Mollusca	2	Lecture	PPT
3.6	Water vascular system in Echinoderms and Larval forms of	2	Lecture	PPT & Videos

	Echinoderms			
UNIT -4 PROCHORDATA & CHORDATA				
4.1	General characters and Classification of Phylum – Chordata	2	Lecture	PPT & Videos
4.2	General characters and Classification of Superclass Agnatha and Pisces	2	Lecture	PPT &Videos
4.3	General characters and Classification of class Amphibia andReptilia	2	Lecture	PPT & Videos
4.4	General characters and Classification of Class Aves and Mammalia	2	Lecture	PPT & Videos
4.5	Scales of Fishes; Economic Importance of Fishes; Neoteny and Paedogenesis	2	Lecture	PPT & Videos
4.6	Adaptive radiation in Reptiles; Birds as Glorified Reptiles&Feet in Birds	2	Lecture	PPT & Videos
4.7	Dentition in Mammals; Placentation in Mammals; Adaptive Convergence in Mammals	3	Lecture	PPT & Videos
UNIT -5 TYPE STUDY				
5.1	Type Study - Phylum- Protozoa: *Paramecium*	3	Chalk & Talk	Black Board
5.2	Phylum- Porifera: *Leucosolenia*	3	Chalk & Talk	LCD
5.3	Phylum- Coelenterata: *Obelia*	3	Lecture	PPT
5.4	Phylum- Arthropoda- Prawn	2	Lecture	PPT
5.5	Phylum- Mollusca- *Lamellidens*	2	Lecture	PPT
5.6	Class- Reptilia- *Calotes*	2	Lecture	PPT
5.7	Class- Mammalia- Rabbit	3	Lecture	PPT

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Session - wise Average	**Better of W1, W2**	**M1+M2**	**MID-SEM TEST**				
	5 Mks.	**5+5=10 Mks.**	**15 Mks**	**5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**

K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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 levels of organization among Invertebrates and Chordates	K1	PSO1
CO 2	Bring out the General characters of Invertebrates.	K1, K2,	PSO1, PSO2
CO 3	Classify the Phyla of Invertebrates and Chordates up to class level.	K1 & K3	PSO4 & PSO5
CO 4	Distinguish between Invertebrates and Chordates.	K1, K2, K3	PSO9
CO 5	Predict the systematic Position of Animals.	K2	PSO9

COURSE DESIGNER:

1. **Dr. A. Tamil Selvi**
2. **Dr. Antony Amala Jayaseeli**

I M.Sc., ZOOLOGY

SEMESTER – I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG1Z2	Microbiology	PG Core	6 Hrs.	4

COURSE DESCRIPTION

To understand the fundamentals of microbial diversity and applications of microbes in Industry and Environment

COURSE OBJECTIVES

- To gain knowledge of microorganisms with particular emphasis on the nomenclature, classification and biology of bacteria, viruses, viriods and prions.
- To understand the microbial genetics and metabolism
- To provide an overview on the utilization and application of microbes in Industry.

UNITS

UNIT –I INTRODUCTION (18 HRS.)

History and Scope of Microbiology - Whittaker's Five Kingdom Concept - Protist, Fungi , Helminthes - Classification according to Bergey's manual- Microscopy - Principle, Components and applications of Phase contrast microscope, Fluorescence microscope, Dark field Microscope and Electron microscope- SEM & TEM.

Self-study –History and Scope of Microbiology

UNIT –II BACTERIA (18 HRS.)

Morphological types - Cell shapes and arrangements - External cell structures - Pili, Flagella and Glycocalyx - Cell envelope - cell walls of Gram negative, Gram positive & Archaebacteria - Nuclear material – bacterial chromosomes and plasmids. Sterilization methods – Physical and chemical - Classification of Culture media (Simple, complex and special media with

examples) - Growth measurements- Influence of Environmental factors on Growth.

Self-study– Classification of Culture media (Simple, complex and special media with examples)

UNIT –III VIRUSES, VIRIODS & PRIONS (18 HRS.)

Brief outline on discovery of viruses, origin of viruses, Nomenclature and classification of viruses - ICTV system of classification, properties of viruses. Morphology and ultrastructure of viruses - capsids and their arrangements; types of envelopes and their composition - viral genome (RNA, DNA) - Structure and importance - Viriods, Prions, Cultivation and assay of viruses.

Self-study– Nomenclature and classification of viruses

UNIT –IV MICROBIAL GENETICS AND METABOLISM (18HRS.)

Genetic Recombination in Bacteria – Conjugation, Transformation and Transduction- Anaerobic Respiration – Photosynthesis: in Cyanobacteria: cyclic and noncyclic photophosphorylation ; fixation of CO_2 - Calvin cycle; Assimilation of inorganic phosphorus and sulfur – Nitrogen fixation. – Symbiotic and asymbiotic relationship.

Self-study - Nitrogen fixation

UNIT –V APPLIED MICROBIOLOGY (18HRS.)

Food Microbiology - Food spoilage - Preservation - Fermented foods - Microorganisms as source of food - Industrial Microbiolgy - Fermentation: lactic acid fermentation, alcoholic fermentation - Production of Antibiotics - Penicillin and organic acids – citric acid ; Bioinsecticides – *Bacillus thuringiensis* - Brief note on Biopolymers, Biosurfactants, bioremediation and Biosensors.

Self-study– Food Microbiology - Food spoilage – Preservation - Bioinsecticides – *Bacillus thuringiensis* - bioremediation

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

REFERENCES:

1. Presscott L.M, Harley J. P and Klein D. A., (1999) *Microbiology*, 4th ed., Mc-Graw Hill, United States.
2. Pommerville J. C., (2010). *Alcamo's Fundamentals of Microbiology*, 8th ed., Jones and Bartlett Publishers.
3. Ingraham J.L and Ingraham C.A., (2005) *Microbiology- An Introduction*, India Binding House.
4. Ananthanarayanan R and Panicker C.K.J., (2005) *Textbook of Microbiology*, 7th ed., Orient Longman.
5. Tortora G.J., Funke B.R., Case C. L., (2005) *Microbiology*: *An Introduction, 8th Edition,* Benjamin Cummings.
6. Dubey R. C., and Maheswari D.K., (2004). *A Textbook of Microbiology, 6th ed.,* Chand and company Ltd.
7. Pelczar M.J., Chan E.C.S.,and Kreig N.R.,(2001). *Microbiology*, *5th ed.,* Tata Mc Graw Hill, New Delhi.

DIGITAL OPEN EDUCATION RESOURCES

https://openstax.org/details/books/microbiology

https://open.oregonstate.education/microbiology/front-matter/preface/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION				
1.1	History and Scope of Microbiology	2	Discussion	Black Board
1.2	Whittaker's Five Kingdom Concept -Protist, Fungi, Helminthes	2	Chalk & Talk	Black Board
1.3	Classification according to Bergey's manual	3	Chalk & Talk	LCD
1.4	Microscopy - Principle, Components and applications of Phase contrast microscope.	3	Lecture	PPT & White board

1.5	Fluorescence microscope,	3	Lecture	Black Board
1.6	Dark field Microscope.	2	Lecture	PPT
1.7	Electron microscope- SEM & TEM	3	Discussion	Google classroom
UNIT -2 BACTERIA				
2.1	Morphological types	2	Chalk & Talk	Black Board
2.2	Cell shapes and arrangements - External cell structures - Pili, Flagella and Glycocalyx	3	Chalk & Talk	LCD
2.3	Cell envelope - cell walls of Gram negative, Gram positive & Archaebacteria	3	Lecture	PPT & White board
2.4	Nuclear material – bacterial chromosomes and plasmids.	3	Lecture	Black Board
2.5	Sterilization methods – Physical and chemical	3	Chalk & Talk	LCD
2.6	Classification of Culture media (Simple, complex and special media with examples**)**	1	Discussion	Black Board
2.7	Growth measurements- Influence of Environmental factors on Growth	3	Lecture	Black Board
UNIT -3 VIRUSES, VIRIODS & PRIONS				
3.1	Brief outline on discovery of viruses, origin of viruses	1	Chalk & Talk	Black Board
3.2	Nomenclature and classification of viruses	2	Discussion	Black Board
3.3	Properties of viruses.	2	Chalk & Talk	LCD
3.4	Morphology and ultra-structure of viruses	3	Lecture	PPT & White board
3.5	Capsids and their arrangements; types of envelopes and their composition.	3	Lecture	Black Board
3.6	Viral genome (RNA, DNA)	2	Lecture	LCD
3.7	Structure and importance - Viriods, Prions,	2	Discussion	Google classroom
3.8	Cultivation and assay of	3	Chalk & Talk	Black Board

	viruses.			
UNIT -4 MICROBIAL GENETICS AND METABOLISM				
4.1	Genetic Recombination in Bacteria – Conjugation, Transformation and Transduction	4	Chalk & Talk	Black Board
4.2	Anaerobic Respiration	2	Chalk & Talk	LCD
4.3	Photosynthesis in Cyanobacteria	2	Lecture	PPT & White board
4.4	Cyclic and noncyclic photophosphorylation	2	Lecture	Black Board
4.5	Fixation of CO_2 - Calvin cycle	2	Lecture	PPT
4.6	Assimilation of inorganic phosphorus and sulfur	3	Discussion	Google classroom
4.7	Nitrogen fixation**.** – Symbiotic and asymbiotic relationship.	3	Discussion	Black Board
UNIT -5 APPLIED MICROBIOLOGY				
5.1	Food Microbiology - Food spoilage - Preservation Subtopics	1	Discussion	Black Board
5.2	Fermented foods - Microorganisms as source of food	2	Chalk & Talk	Black Board
5.3	Industrial Microbiolgy Fermentation: lactic acid fermentation	3	Chalk & Talk	LCD
5.4	Alcoholic fermentation -	2	Lecture	PPT & White board
5.5	Production of Antibiotics - Penicillin	2	Lecture	LCD
5.6	Bioinsecticides – *Bacillus thuringiensis* Organic acids – citric acid	2	Lecture	Black Board
5.7	Biopolymers	2	Discussion	Google classroom
5.8	Biosuractants	3	Lecture	Black Board
5.8	Bioremediation	1	Discussion	LCD
5.9	Biosensors	2	Lecture	Black Board

1

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average 5 Mks.	Better of W1, W2 5+5=10 Mks.	M1+M2 15 Mks	MID-SEM TEST 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non – Scholastic

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 scope of microbiology, taxonomical classification, principle and components of different types of microscopes	**K3**	PSO1
CO 2	Classify bacteria based on morphology, biochemical characteristics and growth parameters	**K4**	PSO1, PSO2
CO 3	Discuss the morphology, classification and cultivation of viruses.	**K3**	PSO1, PSO4
CO 4	Explain the microbial genetics and metabolism of bacteria	**K2**	PSO1, PSO2,PSO6

CO 5	Appraise the role of bacteria in food, industry, medicine, environment and agricultural microbiology	**K5**	PSO1 & PSO5

COURSE DESIGNER:

1. **Dr. Sr. Biji Cyriac**

I M.Sc., ZOOLOGY

SEMESTER – I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG1Z3	CELL & MOLECULAR BIOLOGY	PG Core	6	4

COURSE DESCRIPTION

This course deals with the central dogma of molecular biology and to understand the basis of heredity.

COURSE OBJECTIVES

- To provide an overview of cell structure and functions.
- To understand the cell structure and function at the molecular level , including the flow of information from genes to proteins and its regulation
- To gain knowledge in cancer biology, cell cycle and signaling pathways

UNIT –I :OVERVIEW OF CELL BIOLOGY (18 HRS.)

Structure of animal cell - Cytoskeleton: Structure and organization of actin filaments, intermediate filaments – plasma membrane: structure (review), transport of small molecules, receptor mediated phagocytosis – Cell-cell interactions: Adhesion junctions, tight junctions, gap junctions, plasmodesmata.

Self-study–Structure of animal cell - Cytoskeleton: Structure and organization of actin filaments, intermediate filaments – plasma membrane: structure (review), transport of small molecules, receptor mediated phagocytosis

UNIT –II EUKARYOTIC GENOME & REPLICATION (18 HRS.)

The complexity of Eukaryotic Genomes: Introns, exons, repetitive DNA sequences C_0t curve – C value paradox – Chromosomes & Chromatin – organization of chromatin in nucleosomes. Genome replication: Topological problems – Process – detailed mechanism - *E.coli* and Eukaryotes – Telomere synthesis . DNA repair -Types and mechanism

Self-study– DNA repair -Types and mechanism

UNIT –III TRANSCRIPTION (18 HRS.)

Eukaryotic transcription and its regulation: RNA polymerases and their promoters, Class I, II, and III Transcription factors, Activators, silencers; post transcriptional modifications – capping, polyadenylation and splicing; other RNA processing – rRNA, tRNA; transplicing and RNA editing.

UNIT –IV TRANSCRIPTION REGULATION & TRANSLATION (18 HRS.)

Transcription regulation – Process and control – *lac, trp, ara* operons. MicroRNA - Protein Synthesis: rRNA, tRNA, Ribosome, process and regulation of translation: Protein folding and processing – Protein Sorting and Transport – Endoplasmic reticulum and Lysosomes - Protein degradation

Self-study– *lac* operon

UNIT –V CELL SIGNALING, CELL CYCLE, CELL DEATH & CANCER (18 HRS.)

Signaling molecules and receptors: pathways of intracellular signal transduction: cAMP, GTP, MAP kinase – Cell cycle: phases, regulation, events of M phase – Cell death: events of apoptosis; Cancer: development, types and causes of cancer – Oncovirus hepatitis B & C virus, retrovirus – Oncogenes – tumor suppressor genes.

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

REFERENCES:

1. Lewin B., (2008) *Genes IX,* Jones and Bartlett publishers, Canada.

2. Cooper G.M., (2007) *The Cell - A Molecular Approach*, 2nd ed., ASM Press, Washington D.C.
3. Brown T.A., (2002) *Genomes, 2nd ed.*, Wiley – Liss publications, New York.
4. Weaver R., (1999*) Molecular Biology*, WCB / Mc Graw-Hill, London.
5. Watson J.D., Baker T.A., Stephen B.P., Gann A., Levine M and Losick R., (2004) *Molecular Biology of the Gene, 5th ed.,* Pearson Education.
6. Lodish D.J and Baltimore D., (2004) *Molecular Cell Biology, 5th ed.*, Sci. American Books, W.H. Freeman and Company, New York.
7. Wolfe S.L., (1995) *An Introduction to Cell and Molecular Biology,* Wadsworth Publishing Company, New York.
8. De Robertis, E.D.P and De Robertis E.M.F., (1988) *Cell and Molecular Biology, 8thed.,*International ed., Infomed, HonKong.
9. Geoffery M. Cooper and Hausman Robert E., (2009) *The Cell: A Molecular Approach, 5th ed.*, ASM Press, Washington, D.C., and Sinauer Associates, Inc., Sunderland, Massachusetts.
10. Malacinski G.M., (2008) Freifelder's *Essentials of Molecular Biology, 4th ed.*, Narosa Publishing House, New Delhi.
11. Rastogi S.C., (2003) *Cell and Molecular Biology – 2nd ed.,* New Age International (P) Limited Publishers, Daryaganj, New Delhi.
12. Verma P.S. and Agarwal V.K., (2008*) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand and Company, New Delhi.
13. Plopper G., Sharp D., and Sikorski E., (2015) *Lewin's Cells, 3rd ed., 1st* Indian ed., Jones and Bartlett India Pvt. Ltd., New Delhi.
14. Tropp B.E., (2012*) Molecular Biology- Genes to Proteins, 4th ed.*, 1st Indian ed., Jones and Bartlett India Pvt. Ltd., New Delhi.

DIGITAL OPEN EDUCATION RESOURCES

http://www.axopub.com/Downloads/Cells/Cells_Part_2.pdf

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 : OVERVIEW OF CELL BIOLOGY				
1.1	Structure of animal cell	2	Discussion	Black Board
1.2	Cytoskeleton: Structure and organization of actin filaments	3	Discussion	PPT
1.3	Intermediate filaments	3	Lecture	PPT & White board
1.4	Plasma membrane: structure (review)	2	Lecture	LCD
1.5	Transport of small molecules & receptor mediated phagocytosis	3	Lecture	Black Board
1.6	Cell-cell interactions: Adhesion junctions & tight junctions	3	Chalk & Talk	Black Board
1.7	Gap junctions & plasmodesmata	2	Chalk & Talk	PPT
UNIT -2 EUKARYOTIC GENOME & REPLICATION				
2.1	The complexity of Eukaryotic Genomes	2	Lecture	Green Board Charts
2.2	Introns, exons & repetitive DNA sequences	2	Chalk & Talk	Green Board
2.3	C_0t curve – C value paradox	3	Lecture	PPT & White board
2.4	Chromosomes & Chromatin – organization of chromatin in nucleosomes.	3	Lecture	Black Board
2.5	Genome replication: Topological Problems	2	Lecture	LCD
2.6	Process – detailed mechanism - *E.coli* and Eukaryotes –	4	Discussion	Black Board

	Telomere synthesis			
2.7	DNA repair -Types and mechanism	2	Discussio n	Black Board
UNIT -3 TRANSCRIPTION				
3.1	Eukaryotic transcription and its regulation	3	Chalk & Talk	Black Board
3.2	RNA polymerases and their promoters, Class I, II, and III	3	Chalk & Talk	LCD
3.3	Transcription factors, Activators, silencers	4	Lecture	PPT & White board
3.4	Post transcriptional modifications – capping, polyadenylation and splicing;	3	Lecture	Black Board
3.5	Other RNA processing – rRNA, tRNA; transplicing and	3	Lecture	Black Board
3.6	RNA editing.	2	Discussio n	PPT
UNIT -4 TRANSCRIPTION REGULATION & TRANSLATION				
4.1	Transcription regulation – Process and control	2	Chalk & Talk	Black Board
4.2	l*ac, trp & ara* operons.	3	Chalk & Talk	LCD
4.3	MicroRNA	2	Lecture	PPT & White4boar d
1.4	Protein Synthesis: rRNA, tRNA, Ribosome,	4	Lecture	Black Board
4.5	Process and regulation of translation:	2	Lecture	Black Board
4.6	Protein folding and processing – Protein Sorting and	2	Discussio n	Google classroom
4.7	Transport – Endoplasmic reticulum and Lysosomes	2	Lecture	LCD
4.8	Protein degradation	1	Discussio n	Black Board
UNIT – 5 CELL SIGNALING, CELL CYCLE, CELL DEATH & CANCER				
1.1	Signaling molecules and	2	Chalk &	Black Board

	receptors		Talk	
1.2	Pathways of intracellular signal transduction: cAMP, GTP, MAP kinase –	4	Chalk & Talk	LCD
1.3	Cell cycle: phases, regulation, events of M phase	4	Lecture	PPT & White board
1.4	Cell death: events of apoptosis	2	Lecture	Smart Board
1.5	Cancer: development	1	Lecture	Black Board
1.6	Types and causes of cancer	1	Discussion	Google classroom
1.7	Oncovirus - hepatitis B & C virus & retrovirus	2	Chalk & Talk	LCD
1.8	Oncogenes – tumor suppressor genes	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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 ultrastructure and functions of Cytoskeletons and Plasma membrane	**K5**	PSO1
CO 2	Discuss the complexicity of eukaryotic genome organization and its replication in Prokaryotes & Eukaryotes	**K3**	PSO2
CO 3	Describe the process of transcription and post transcriptional modification in Eukaryotes	**K2**	PSO4
CO 4	Evaluate the regulation of transcription and translation in Prokaryotes & Eukaryotes	**K5**	PSO2 & PSO5
CO 5	Assess the events of cell cycle, cell signalling pathways, cell death and cancer	K5	PSO1 & PSO9

COURSE DESIGNER:

1. **Dr. N. Malathi**
2. **Dr. Sr. Biji Cyriac**

I M.Sc., ZOOLOGY

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**19PG1Z4**	**Lab in Animal Diversity & Microbiology**	**PG Core**	**4 Hrs.**	**2**

COURSE DESCRIPTION

This course deals with the learning skills of microbial techniques and fundamentals of diversity of species.

COURSE OBJECTIVE

- Understand the fundamental organization of animals.
- Develop the practical skills in microscopy, handling microbial cultures and staining techniques of microbes.
- Acquire specialized microbiological laboratory skills applicable to microbiological research and reporting the observations.

ANIMAL DIVERSITY

1. Mounting of Body setae of earthworm (Spotters)

2. Mounting of mouth parts of Honey bee and mosquito

3. Mounting of Ctenoid / Placoid scale (Spotters)

4. Dissection of Frog Viscera using virtual dissection software (Spotters/Chart)

5. Visit to Coastal area

SPOTTERS

Amoeba, Ascon Sponge, Obelia Colony, *Taenia solium*, *Ascaris* (Male & Female), *Nereis*, Limulus, Octopus, Starfish (Oral & Aboral view)

SPOTTERS

Prochordata – Amphioxus (entire); Chordata – Anguilla (Eel), Toad (Bufo), Hyla, Ichthyophis, Cobra, Viper, Enhydrina, Chamaeleon, Draco, Chelone, Echidna, Manis

MICROBIOLOGY

1.Laboratory biosafety guidelines

2. Sterilization techniques

3. Media preparation

4. Isolation and enumeration of microbes from different sources – soil, air, water, food.

5. Pure culture techniques, preparation and maintenance of stock culture

6.Measurement of growth of microorganisms – growth curve (turbidity method) and Hemocytometer count, Colony counter.

7. Effect of Temperature and UV on bacterial growth.

8. Staining Techniques – Simple, Gram's, endospore, negative.

9. Motility test – Hanging drop method

10. Biochemical characterization of unknown isolates – Carbohydrate fermentation, IMViC test, Urease test, Oxidase test, TSI test, H2S test, catalase test,

11. Extracellular enzymatic activities – Starch, casein and gelatin hydrolysis

12. Enumeration of coliforms in water-potability analysis – MPN method.

13. Antibiotic sensitivity testing: a. Kirby-Bauer disc diffusion method

REFERENCE BOOKS:

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. Cappucino J. G. and Sherman N., (2008*). Microbiology - A Laboratory manual*, Pearson Education (Singapore).
6. Sharma K., (2005) *Manual of Microbiology Tools and Techniques*, Bababarkha Nath printers, Delhi.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
ANIMAL DIVERSITY				
1.	Mounting of Body setae of earthworm (Spotters)	4	Demonstration and Hands on training	Earthworm
2.	Mounting of mouth parts of Honey bee and Mosquito	4	Demonstration and Hands on training	Honey bee And Mosquito
3.	Mounting of Ctenoid / Placoid scale (Spotters)	4	Demonstration and Hands on training	Fish Scales
4.	Dissection of Frog Viscera using virtual dissection software (Spotters/Chart)	4	Virtual Dissection	Frog
5.	Visit to Coastal area	4		
6.	**SPOTTERS** *Amoeba,* Ascon Sponge, Obelia Colony, *Taenia solium*, *Ascaris* (Male & Female), *Nereis*, Limulus, Octopus, Starfish (Oral & Aboral view)	4	Explanation	Spotters
7.	**SPOTTERS** Prochordata – Amphioxus (entire); Chordata – Anguilla (Eel), Toad (Bufo), Hyla, Ichthyophis, Cobra, Viper, Enhydrina, Chamaeleon, Draco, Chelone, Echidna, Manis	4	Explanation	Spotters
Microbiology				
1.	Laboratory biosafety guidelines	4	Explanation	
2.	Sterilization techniques	4	Demonstration and Hands on training	
3.	Media preparation	4	Demonstration and Hands on training	Nutrient Agar and Broth

4.	Isolation and enumeration of microbes from different sources – soil, air, water, food.	4	Demonstration and Hands on training	Soil, Water and Food
5.	Pure culture techniques, preparation and maintenance of stock culture	4	Demonstration and Hands on training	
6.	Measurement of growth of microorganisms – growth curve (turbidity method) and Hemocytometer count, Colony counter.	4	Demonstration and Hands on training	
7.	Effect of Temperature and UV on bacterial growth.	4	Demonstration and Hands on training	Bacteria
8.	Staining Techniques – Simple, Gram's, endospore, negative.	4	Demonstration and Hands on training	Bacteria
9.	Motility test – Hanging drop methods	4	Demonstration and Hands on training	Bacteria
10.	Biochemical characterization of unknown isolates – Carbohydrate fermentation, IMViC test, Urease test, Oxidase test, TSI test, H2S test, catalase test,	4	Demonstration and Hands on training	Bacteria
11.	Extracellular enzymatic activities – Starch, casein and gelatin hydrolysis	4	Demonstration and Hands on training	Bacteria
12.	Enumeration of coliforms in water-potability analysis – MPN method.	4	Demonstration and Hands on training	Bacteria
13.	Antibiotic sensitivity testing:a. Kirby-Bauer disc diffusion method	4	Demonstration and Hands on training	Bacteria

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session -wise Average 5 Mks.	Better of W1, W2 5+5=10 Mks.	M1+M2 15 Mks	MID-SEM TEST 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Identify the diversity of animals.	K3	PSO1& PSO2
CO 2	Explain the fundamental organization of cells.	K2	PSO2
CO 3	Prepare different types of media.	K3	PSO5
CO 4	Demonstrate bacterial isolation technique and maintain pure culture.	K2	PSO8 & PSO9
CO 5	Identify unknown bacteria by biochemical testing.	K3	PSO2, PSO7 & PSO9

COURSE DESIGNER: Academic Council 25.09.2020

Dr. X. Devanya Rosaline

I M.Sc., ZOOLOGY

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**19PG1Z5**	**Lab in Cell & Molecular Biology**	**Major Practical**	**4 Hrs.**	**2**

COURSE DESCRIPTION

It includes cell biology experiments such as observation of mitotic stages in onion root tip and visualizing giant chromosome in *Chironomus* larva and isolation and estimation of DNA and RNA.

COURSE OBJECTIVES

To acquire skills to cells at different stages of mitosis and isolating and estimating various biomolecules

EXPERIMENTS:

1. Laboratory biosafety guidelines Preparation and identification of mitotic stages using onion root tip
2. Preparation and identification of meiotic stages in grasshopper testis
3. Observation of giant chromosomes in *Chironomus* larva
4. Yeast Cell Budding
5. Cell fractionation technique
6. General routine for preparation of tissues
7. Isolation of total DNA from liver/ spleen & estimation of DNA by spectrophotometric method.
8. Estimation of DNA by Diphenylamine method using calf thymus DNA
9. Determination of Tm value of isolated DNA
10. Isolation of total RNA from mammalian tissue /Yeast
11. Estimation of RNA by Orcinol method

12. Electrophoretic separation of DNA
13. Spotters: Microscopy: Inverted microscope, Flow cytometry, Phase contrast microscope, DNA double helix, A DNA, B DNA & Z DNA

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. Sambrook and Russel, (2001). *Molecular Cloning Laboratory Manual*, 3rd ed., Cold Spring Harbor Laboratory Press, New York.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Experiments				
1.1	Laboratory biosafety guidelines Preparation and identification of mitotic stages using onion root tip	4	Lecture & Demonstration	Blackboard & Specimen
1.2	Preparation and identification of meiotic stages in grasshopper testis	4	Demonstration	Specimen
1.3	Observation of giant chromosomes in *Chironomus* larva	4	Demonstration	Specimen
1.4	Yeast Cell Budding	4	Demo	Specimen
1.5	Cell fractionation technique	4	Demo	Specimen
1.6	General routine for	4	Demo	Specimen

	preparation of tissues			
1.7	Isolation of total DNA from liver/ spleen & estimation of DNA by spectrophotometric method.	4	Hands on training	Tissue sample
1.8	Estimation of DNA by Diphenylamine method using calf thymus DNA	4	Hands on training	Calf Thymus DNA
1.9	Determination of Tm value of isolated DNA	4	Hands on training	Calf Thymus DNA
1.10	Isolation of total RNA from mammalian tissue /Yeast	4	Hands on training	Tissue sample
1.11	Estimation of RNA by Orcinol method	4	Hands on training	Std. RNA, tissue sample
1.12	Electrophoretic separation of DNA	4	Hands on training	Agarose gel electrophoretic unit
1.13	Spotters: Microscopy: Inverted microscope, Flow cytometry, Phase contrast microscope, DNA double helix, A DNA, B DNA & Z DNA	4	Observation	Models, Microscope

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-

K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Identify and sketch the various microscopy	K1	PSO1
CO 2	Recall the preparation of tissues	K1	PSO1
CO 3	Estimate the quantity of DNA and RNA	K2	PSO3
CO 4	Infer the qualitative estimation of DNA and RNA	K2	PSO3
CO 5	Compute the mitotic index	K4	PSO9
CO 6	Demonstrate the isolation of genomic DNA	K3	PSO3
CO 7	Interpret the mitotic stages of onion root tip	K3	PSO3

COURSE DESIGNER:

Dr. J. Asnet Mary

I M.Sc., ZOOLOGY

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PGZEDC1	Herbal Medicine	PG Core	3 Hrs.	3

COURSE DESCRIPTION

This course deals with the study of medicinal plants and therapeutic values of herbs.

COURSE OBJECTIVES

- To understand the ethnobotanical importance of indigenous medicinal plants and their implications for common ailments.
- To know the key active constituents of the herbal products that are responsible for biological activity.
- Define the importance of nutraceuticals in healthcare.
- To discuss the functional food, herbal supplements and their effects on health.

UNITS

UNIT I: INTRODUCTION (9 HRS.)

History of Herbal medicine - Traditional systems of Medicine – Siddha, Ayurveda, Homeopathy, Unani & Acupuncture - Classification of medicinal plants based on Useful part - Wood, Root, Bark, Leaf & Seed; Usage – Medicinal & Culinary; Active constituents- Aromatic, Astringent - Bitter &Mucilagenous herbs - Doctrines of signature.

UNIT II: COMMON MEDICINAL PLANTS (9 HRS.)

Morphology, Chemical constituents and Medicinal uses of *Aloe vera* (Kumari), *Acalypha indica* (Indian Nettle),*Trigonella foenum-graecum*(Fenugeek), *Cyanodon dactylon* (Bermuda grass),*Vitex negundo* (Chinese chaste tree), *Adathoda vasica* (Malabar Nut), *Piper betel*(Betel leaf),

Curcuma longa (Turmeric), *Azadirachta indica* (Neem), *Andrographis paniculata* (Green chireta), *Emblica officinalis* (Amla), *Piper nigrum* (Pepper).

UNIT III: HERBAL MEDICATION (9 HRS.)

Herbal remedies for common cold – *Ocimum basilicum*(Holy Basil), Renal implication of herbal remedies - *Musa paradisiaca*(Plantain), *Tribulus terrestris*(Puncture vine) - Herbal medicines for Gastro intestinal problems – *Allium sativum* (Garlic), *Zingiber officinale* (Ginger) &*Trachyspermum ammi* (Caraway)- Herbal remedies for Hepatic disorders – *Phyllanthus niruri*(Stonebreaker) , *Eclipta alba* (False daisy)- Herbal remedies for skin diseases – *Holarrhena antidysenterica* (Tellicherry Bark).

UNIT IV: NUTRACEUTICALS AND LIFE STYLE DISORDERS(9 HRS.)

Definition – Nutraceutical and therapeutic value of Medicinal Plants – Nutritional value and uses of *Amarathus dubius*(Greens), *Moringa olerifera* (Drumstick), *Macrotyloma uniflorum*(Horse gram) - Role of Nutraceuticals in Diabetic cure, Management of Obesity, Constipation, Blood pressure.

UNIT V: PREPARATION OF HERBAL PRODUCTS (9 HRS.)

Herbal Face Powder- Bath powder – Herbal hair care: hair conditioner & hair oil - Cough choornam- Anti-diabetic Powder- Triphala choornam – Asthavargha Choornam – Prasava Lehiyam- Health Mix powder - Preparation of Amla candy, Ginger candy, Gulkand & Sherbath.

&Cardiovascular diseases – Female health disorders- Menstrual problems.

REFERENCE BOOKS:

1. Schulz V, Haensel R and Tyler V.E., Rational Phytotherapy, A Physicians Guide to Herbal Medicine, Springer Publishers, Berlin.
2. McKenna D.J., Jones K. and Hughes K., Botanical Medicines, The Desk Reference for Major Herbal Supplements, The Haworth Herbal Press, New York.
3. Natural Medicines Comprehensive Database.
4. Maeilanandhan, S.K.M., (2010). *Siddha and Ayuveda -Therapeutic Index-Siddha, Sri Lakshmi chirtaprinters,.*

CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1INTRODUCTION				
1.1	History of Herbal medicine.	2	Chalk & Talk	Black Board
1.2	Traditional systems of Medicine – Siddha, Ayurveda, Homeopathy, Unani & Acupuncture.	2	Chalk & Talk	LCD
1.3	Classification of medicinal plants based on Useful part - Wood, Root, Bark, Leaf & Seed.	3	Lecture	PPT & White board
1.4	Usage – Medicinal & Culinary; Active constituents- Aromatic, Astringent - Bitter &Mucilagenous herbs.	1	Lecture	Black Board
1.5	Doctrines of signature.	1	Lecture	Black Board
UNIT -2 COMMON MEDICINAL PLANTS				
2.1	Morphology, Chemical constituents and Medicinal uses of *Aloe vera* (Kumari),	1	Lecture	Black Board
2.2	*Acalypha indica* (Indian Nettle),*Trigonella foenum-graecum* (Fenugeek), *Cyanodon dactylon* (Bermuda grass),)	2	Chalk & Talk	Black Board
2.3	*Vitex negundo* (Chinese chaste tree), *Adathoda vasica* (Malabar Nut),	2	Chalk & Talk	Black Board
2.4	*Curcuma longa* (Turmeric), *Azadirachta indica* (Neem)	2	Chalk & Talk	Black Board
2.5	*Azadirachta indica* (Neem), *Andrographis paniculata* (Green chireta), *Emblica officinalis* (Amla), *Piper nigrum* (Pepper).	2	Lecture	White board

UNIT -III HERBAL MEDICATION				
3.1	Herbal remedies for common cold – *Ocimum basilicum*(Holy Basil)	1	Chalk & Talk	Black Board
3.2	Renal implication of herbal remedies - *Musa paradisiacal* (Plantain), *Tribulus terrestris*(Puncture vine)	2	Chalk & Talk	Black Board
3.3	Herbal medicines for Gastro intestinal problems – *Allium sativum* (Garlic), *Zingiber officinale* (Ginger) &*Trachyspermum ammi* (Ajowan caraway)	2	Lecture	White board
3.4	Herbal remedies for Hepatic disorders – *Phyllanthus niruri*(Bahupatra) *, Eclipta alba* (Bringha raj)	2	Lecture	Black Board
3.5	Herbal remedies for skin diseases – *Holarrhena antidysenterica* (Tellicherry bark).	2	Lecture	Black Board
TITLE-IV NUTRACEUTICALS AND LIFE STYLE DISORDERS				
4.1	Definition – Nutraceutical and therapeutic value of Medicinal Plants	2	Chalk & Talk	Black Board
4.2	Physical Properties, Nutritional value and uses of *Amarathus dubius* spp.(Greens)	1	Chalk & Talk	Black Board
4.3	*Moringa olerifera* (Drumstick), *Macrotyloma uniflorum*(Horse gram)	2	Lecture	White board
4.4	Role of Nutraceuticals in Diabetic cure, Management of Obesity, Constipation.	2	Lecture	Black Board
4.5	Blood pressure &	2	Lecture	Black Board

	Cardiovascular diseases – Female health disorders.			
UNIT –V PREPARATION OF HERBAL PRODUCTS				
5.1	Herbal Face Powder- Bath powder – Herbal hair care: hair conditioner & hair oil	2	Demonstrations	Raw Material
5.2	Cough choornam- Anti-diabetic Powder- Triphala choornam – Asthavargha Choornam	2	Demonstrations	Raw Material
5.3	Prasava Lehiyam- Health Mix powder	1	Demonstrations	Raw Material
5.4	Preparation of Amla candy, Ginger candy,	2	Demonstrations	Raw Material
5.5	Gulkand & Sherbath	1	Demonstrations	Raw Material
5.6	Cardiovascular diseases – Female health disorders- Menstrual problems.	1	Chalk & Talk	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Session -wise Average 5 Mks.	**Better of W1, W2 5+5=10 Mks.**	**M1+M2 15 Mks**	**MID-SEM TEST 5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Make use of alternative medicinal methods.	K3	PSO1& PSO2
CO 2	Infer the importance of herbs used in day today life.	K2	PSO3
CO 3	Categorize the usage of herbs for different ailments.	K4	PSO4
CO 4	Solve the life style disorders with food supplements.	K3	PSO12
CO 5	Prepare various herbal products.	K3	PSO 10& PSO12

COURSE DESIGNER:
Dr. X. Devanya Rosaline

I M.Sc., ZOOLOGY

SEMESTER – II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG2Z6	Genetics	Major Core	6	4

COURSE DESCRIPTION

This course provides the knowledge of Mendelian inheritance and understanding the molecular basis of mutation which leads to genetic defects in human.

COURSE OBJECTIVES

- To understand the mechanism of sex determination in different organisms
- To enable the students to draw pedigree chart for their family
- To understand the consequence of chromosomal aberrations in human
- To know the effects of somatic and germinal mutation

UNITS

UNIT –I BASIC GENETICS (18HRS.)

Monohybrid crosses - Dominance, recessiveness - Co dominance, Semi dominance, Lethals – Principle of Independent assortment- Dihybrid ratios, Trihybrid ratio, gene interactions, epistasis,pleiotropy, penetrance and expressivity. Multiple alleles: ABO blood types, Rh factor, Probability of mendelian inheritance.

Self - study-Monohybrid crosses - Dominance, recessiveness - Co dominance, Semi dominance.Multiple alleles: ABO blood types, Rh factor

UNIT –II SEX DETERMINATION AND SEX LINKAGE (18 HRS.)

Mechanisms of Sex determination: Simple mechanisms, XX-XY mechanism of Sex determination, Y chromosome and sex determination in mammals,

Genic Balance theory, Haplodiploidy, mosaics and Gynandromorphs. Sex differentiations- sex chromatin, dosage compensation, Fragile X chromosome and mental retardation – Sex influenced Dominance – Sex limited gene expression – Sex linked inheritance: Patterns of inheritance of Sex –linked genes, X-linked traits in humans, deleterious recessive Sex-linked genes in humans, pedigree analysis.

UNIT –III LINKAGE, CROSSING OVER, CHROMOSOME MAPPING(18 HRS.)

Linkage; types, factor affecting linkage, molecular mechanism- Crossing over – Molecular mechanism - Chromosome Mapping: Two factor crosses, three factor crosses, interference, QTL mapping and FISH. Transposable genetic elements in Prokaryotes: IS elements, Eukaryotes: Yeast TY element.

UNIT –IV MUTATION AND CHROMOSOMAL ABERRATION(18 HRS.)

Chromosome structural variations - Positional effects – Human Chromosome techniques – Cri du chat syndrome. Variations in chromosome number: Trisomy in humans- Down's Syndrome, Trisomy-13, Trisomy-18, Klinefelter's syndrome, Turner syndrome – Genetic counselling. Phenotypic effects of mutation: Somatic and germinal mutations, mutant Haemoglobins, Pleiotropy, Back mutations and suppressor mutations – molecular basis of mutation - Radiation induced mutation: Ionizing radiation, Ultraviolet radiation – Chemically induced mutation: Base analogs, Nitrous acid, Actidines, Alkylating and hydroxylating agents.

Self-Study -Variations in chromosome number: Trisomy in humans- Down's Syndrome, Trisomy-13, Trisomy-18

UNIT –V MICROBIAL GENETICS (18 HRS.)

Transformation: Detection of transformation, competence, DNA uptake, molecular mechanism, mapping – Transduction: Generalized transduction, Specialized transduction – Conjugation: F-Mediated sexduction, Hfr transfer, linkage mapping, isolation of Hfr strains – Plasmids and Episomes.

Self - Study-Transformation: Detection of transformation, competence, DNA uptake

DIGITAL OPEN EDUCATIONAL RESOURCES

http://depts.washington.edu/genetics/courses/genet371b-aut99/371B_pdf.html

http://www.auburn.edu/academic/classes/biol/1020/bowling/lecturenotes/chapter14activity.pdf

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2. David F., (1987) *Microbial Genetics*, Jones and Bartlett Publishers, Inc., USA.

3. Snyder L., (2007) *Molecular Genetics of Bacteria*, 3rd ed., Blackwell Publishing Company, Oxford, UK.

4. Johnston J. R., (1994) *Molecular Genetics of Yeast* - A Practical Approach, 1st ed., Oxford University Press, UK.

5. Fred B (2008) *"Principles of cancer genetics"*, Springer science.

7. Primrose S.B. and Twyman R.M., (2003) *Principles of Genome Analysis and Genomics, 3rd ed.,* Blackwell Publishing Company, Oxford, UK.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**BASIC GENETICS**			
1.1	Principle of Independent assortment- Dihybrid ratios	5	Chalk & Talk	Black Board
1.2	Trihybrid ratio, gene interactions	4	Chalk & Talk	LCD
1.3	Epistasis,pleiotropy, penetrance and expressivity	4	Chalk & Talk	Black Board
1.4	Probability of mendelian inheritance.	5	Chalk & Talk	Black Board
1.5	Self - study- Monohybrid crosses - Dominance, recessiveness - Co dominance, Semi dominance. Multiple alleles: ABO blood		Discussion	

	types, Rh factor			
UNIT -2	**SEX DETERMINATION AND SEX LINKAGE**			
2.1	Mechanisms of Sex determination: Simple mechanisms, XX-XY mechanism of Sex determination.	3	Chalk & Talk	Black Board
2.2	Y chromosome and sex determination in mammals	2	Chalk & Talk	Black Board
2.3	Genic Balance theory	1	Chalk & Talk	Black Board
2.4	Haplodiploidy, mosaics and Gynandromorphs.	2	Chalk & Talk	Black Board
2.5	Sex differentiations- sex chromatin, dosage compensation,	2	Chalk & Talk	Black Board
2.6	Fragile X chromosome and mental retardation	2	Chalk & Talk	Black Board
2.7	Sex influenced Dominance – Sex limited gene expression	2	Chalk & Talk	Black Board
2.8	Sex linked inheritance: Patterns of inheritance of Sex –linked genes, X-linked traits in humans	2	Chalk & Talk	Black Board
2.9	deleterious recessive Sex-linked genes in humans, pedigree analysis.	2	Lecture	Black Board
UNIT -3 LINKAGE, CROSSING OVER, CHROMOSOME MAPPING				
3.1	Linkage; types, factor affecting linkage, molecular mechanism	3	Chalk & Talk	Black Board
3.2	Crossing over – Molecular mechanism	3	Chalk & Talk	LCD
3.3	Chromosome Mapping: Two factor crosses, three factor crosses, interference	4	Lecture	PPT
3.4	QTL mapping and FISH	2	Lecture	Black Board
3.5	Transposable genetic elements in Prokaryotes: IS elements	3	Chalk & Talk	Black Board
3.6	Eukaryotes: Yeast TY element.	3	Chalk & Talk	Google classroom

UNIT -4 MUTATION AND CHROMOSOMAL ABERRATION				
4.1	Chromosome structural variations - Positional effects	2	Chalk & Talk	Black Board
4.2	Human Chromosome techniques – Cri du chat syndrome.	2	Chalk & Talk	Black Board
4.3	Klinefelter's syndrome, Turner syndrome – Genetic counselling	2	Chalk & Talk	PPT
4.4	Phenotypic effects of mutation: Somatic and germinal mutations	2	Chalk & Talk	Black Board
4.5	mutant Haemoglobins, Pleiotropy, Back mutations and suppressor mutations	3	Chalk & Talk	Black Board
4.6	molecular basis of mutation	2	Chalk & Talk	Black Board
4.7	Radiation induced mutation: Ionizing radiation, Ultraviolet radiation	2	Chalk & Talk	Black Board
4.8	Chemically induced mutation: Base analogs, Nitrous acid, Actidines, Alkylating and hydroxylating agents.	3	Chalk & Talk	Black Board
4.9	Self-Study - Variations in chromosome number: Trisomy in humans- Down's Syndrome, Trisomy-13, Trisomy-18		Discussion	
UNIT -5 MICROBIAL GENETICS				
5.1	Transformation: molecular mechanism, mapping	3	Lecture	PPT
5.2	Transduction: Generalized transduction, Specialized transduction	4	Chalk & Talk	Black Board
5.3	Conjugation: F-Mediated sexduction, Hfr transfer	4	Chalk & Talk	PPT

5.4	linkage mapping, isolation of Hfr strains	4	Chalk & Talk	Black Board
5.5	Plasmids and Episomes	3	Chalk & Talk	Black Board
5.6	Self - Study- Transformation: Detection of transformation, competence, DNA uptake		Discussion	

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non – Scholastic

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	Find the pattern of inheritance of	K1	PSO1

	traits by various crosses.		
CO 2	Compare the patterns of sex determination in various organisms.	K2	PSO1
CO 3	Discuss the mechanism of crossing over and linkage	K6	PSO1
CO 4	Analyse uniqueness of chromosome mapping.	K4	PSO2
CO 5	Identify the types of variation in chromosome.	K3	PSO1 & PSO2
CO 6	Assess the process of bacterial transformation, transduction and conjugation.	K5	PSO2

COURSE DESIGNER:

1. **Dr. N. Malathi**
2. **Dr. S. Barathy**

I M.Sc., ZOOLOGY

SEMESTER – II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG2Z7	Evolution	PG Core	6	4

COURSE DESCRIPTION

To understand the origin of life on the earth through the process of evolution

COURSE OBJECTIVES

- To understand the evidences, theories and the mechanism of evolution.
- To understand natural selection and speciation.
- To compare the human evolution with primates

UNITS

UNIT –I ORIGIN AND EVOLUTION OF LIFE (18 HRS.)

Molecular and biological evolution - Introduction to evolutionary biology - Origin of basic biological molecules, Theories of the origin of life – Spontaneous generation, Biochemical evolution: Oparin – Haldane Concept, Urey- Miller Experiment. - Evolution of Prokaryotes - origin of eukaryotic cells - evolution of unicellular eukaryotes - Origin of photosynthesis and aerobic metabolism – Geological time scale

Self-study - Biochemical evolution: Oparin – Haldane Concept, Urey-Miller Experiment

UNIT –II EVIDENCES AND THEORIES OF EVOLUTION (18 HRS.)

Single celled organisms to kingdoms - Evidences for organic evolution – structural and functional analogy - Comparative morphological and anatomical, embryological, physiological, biochemical and palaeontological

evidence. The theories of Lamarckism, Neo Lamarckism, Darwinism, Neo Darwinism, Darwin – Wallace theory and mutation theory of De Vries.

Self-study - The theories of Lamarckism, Neo Lamarckism,Wallace theory and mutation theory of De Vries

UNIT –III MECHANISM OF EVOLUTION (18 HRS.)

Nature and types of variation – Mutation – classification of mutation – Chromosomal aberration – Genetic drift, Mutation, Recombination and Gene flow. Gene frequency and Hardy-Weinberg principle – Bottle neck effect.

Self-study - Mutation – classification of mutation

UNIT –IV NATURAL SELECTION AND SPECIATION (18 HRS.)

Natural selection in action - types of selection - Directional, Disruptive and Stabilizing. Nature and origin of species **-** Species and similarity, species concept and origin of species – microevolution – macroevolution and mega evolution – punctuated equilibrium – coordinate theory – Spemann experiment - Speciation: geographic, allopatric, sympatric, peripatric, parapatric - Isolating mechanisms - mass extinctions and adaptive radiation - Mimicry and colouration - co-evolution.

Self-study - Mass extinctions and adaptive radiation - Mimicry and colouration - co-evolution.

UNIT –V MOLECUALR AND HUMAN EVOLUTION (18 HRS.)

Molecular evolution: evolution of haemoglobin and Cytochrome c – History of human evolution **–** Biological evolution of human **-** The earliest hominins – bipedalism and brain size of the early human evolution - paleontological, **c**ulture and social evolution – types of cultural evolution . Fossil records and dating methods.

Self-study - History of human evolution – Biological evolution of human

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

DIGITAL OPEN EDUCATIONAL RESOURCES

http://ib.berkeley.edu/courses/bio1b/evolutionspring11/pdfs/MoritzNotes1.pdf

https://biomed.brown.edu/Courses/BIO48/lectures

https://www.biologysimulations.com/genetic-drift-bottleneck-event

https://www.biologysimulations.com/mutation

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2. Rastogi V.B., (2017) *Organic Evolution (Evolutionary Biology) 13th ed.,* Kedar Nath Ram Nath publications, Meerut.
3. Rastogi V.B., (2015) *Organic Evolution (Evolutionary Biology) 13th ed.,* Kedar Nath Ram Nath publications, Meerut.
4. Chattopadhyay S., (2008). *Evolution adaption and Ethology , 2nd* Edition. Books and Allied (P) Ltd.
5. Moody P.A., (1992) *Introduction to Evolution 3rd ed.*, Kalyani publishers, New Delhi.
6. Renganathan T.K., (1980) *Evolution, 3rd revised ed.,* Sri Raman Press, Tuticorin.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 ORIGIN AND EVOLUTION OF LIFE				
1.1	Molecular and biological evolution - Introduction to evolutionary biology	2	Chalk & Talk	Black Board
1.2	Origin of basic biological molecules,	2	Chalk & Talk	LCD
1.3	Theories of the origin of life – Spontaneous generation	3	Lecture	PPT & White board
1.4	Biochemical evolution: Oparin – Haldane Concept, Urey-Miller Experiment.	2	Discussion	LCD
1.5	Evolution of Prokaryotes	2	Lecture	Black

				Board
1.6	Origin of eukaryotic cells - evolution of unicellular eukaryotes -	2	Discussion	Google classroom
1.7	Origin of photosynthesis and aerobic metabolism	3	Lecture	Black Board
1.8	Geological time scale	2	Discussion	PPT
UNIT -2 : EVIDENCES AND THEORIES OF EVOLUTION				
2.1	Single celled organisms to kingdoms	1	Lecture	Green Board Charts
2.2	Evidences for organic evolution – structural and functional analogy	2	Chalk & Talk	Green Board
2.3	Comparative morphological and anatomical evidences	2	Lecture	PPT & White board
2.4	Embryological evidences	2	Lecture	Smart Board
2.5	Physiological & biochemical evidences	2	Lecture	Black Board
2.6	Palaeontological evidence.	1	Discussion	Google classroom
2.7	The theories of Lamarckism, Neo Lamarckism,	3	Discussion	LCD
2.8	Darwinism, Neo Darwinism,	2	Discussion	PPT
2.9	Darwin – Wallace theory and mutation theory of De Vries	3	Discussion	Black Board
UNIT -3 MECHANISM OF EVOLUTION				
3.1	Nature and types of variation	3	Chalk & Talk	Black Board
3.2	Mutation – classification of mutation	3	Chalk & Talk	LCD
3.3	Chromosomal aberration	3	Lecture	PPT & White board
3.4	Genetic drift, Mutation, Recombination and Gene flow.	3	Lecture	Smart Board
3.5	Gene frequency and Hardy-Weinberg principle –	3	Lecture	Black Board

3.6	Bottle neck effect	3	Chalk & Talk	LCD
UNIT -4 NATURAL SELECTION AND SPECIATION				
4.1	Natural selection in action -	1	Chalk & Talk	Black Board
4.2	Types of selection - Directional, Disruptive and Stabilizing.	2	Chalk & Talk	LCD
4.3	Nature and origin of species - Species and similarity	2	Lecture	PPT & White board
4.4	Species concept and origin of species –	2	Lecture	Smart Board
4.5	Microevolution – macroevolution and mega evolution –	2	Lecture	Black Board
4.6	Punctuated equilibrium – coordinate theory – Spemann experiment -	2	Discussio n	Google classroom
4.7	Speciation: geographic, allopatric, sympatric, peripatric & parapatric	2	Lecture	Black Board
4.8	Isolating mechanisms	2	Discussio n	PPT
4.9	Mass extinctions and adaptive radiation -	1	Discussio n	Black Board
4.10	Mimicry and colouration - co-evolution	2	Lecture	Black Board
UNIT -5 MOLECUALR AND HUMAN EVOLUTION				
5.1	Molecular evolution	2	Chalk & Talk	Black Board
5.2	Evolution of haemoglobin and Cytochrome C	2	Chalk & Talk	LCD
5.3	History of human evolution	3	Lecture	PPT & White board
5.4	Biological evolution of human - The earliest hominines – bipedalism and brain size of the early human evolution -	3	Lecture	Black Board
5.5	Paleontological, **c**ulture and social evolution –	4	Lecture	LCD
5.6	Types of cultural evolution.	2	Discussio n	Google classroom
5.7	Fossil records and dating methods	2	Lecture	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non – Scholastic

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 origin and evolution of life	K1	PSO1
CO 2	Categorize the evidences and theories of organic evolution	K4	PSO2
CO 3	Describe the mechanism of evolution	K2	PSO2
CO 4	Write about the natural selection and speciation	K3	PSO4
CO 5	Explain the molecular and	K5	PSO5

	human evolution		

COURSE DESIGNER:

1. **Dr. Sr. Biji Cyriac**

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG2Z8	Biochemistry	PG Core	90 Hrs.	6

COURSE DESCRIPTION

The course is designed to provide firm foundation in the principles of Biochemistry by providing knowledge on structure, biochemical properties of biomolecules and the role of these biomolecules in the major metabolic pathways of a living system.

COURSE OBJECTIVES

- Gain comprehensive knowledge on the structure and functioning of Biomolecules.
- Understand the role of biomolecules, enzymes and hormones in the organization and regulation of Human Metabolic Pathways.
- Apply this knowledge to carry out the biochemical experiments.

UNITS

UNIT –I CARBOHYDRATES (18 HRS.)

Outline classification of Carbohydrates- Structure and biological significance of Glucose -Fructose- Lactose - Sucrose- Starch - Glycogen. Carbohydrate Metabolism: Metabolism and regulation of Glycolysis, Kreb's Cycle, Electron Transport System and Energetics; Glycogenesis, Glycogenolysis, Outline Classification Gluconeogenesis, HMP Shunt pathway and Uronic acid pathway.

UNIT –II PROTEINS (18 HRS.)

Structure of amino Acids based on the composition of R group, General properties of Amino Acids; Organization of Protein structure: Primary structure - Secondary structure - Tertiary - Quaternary structure, Ramachandran plot.Biosynthesis of Amino Acids, Catabolic reactions of Amino acids –Transamination- Deamination- Decarboxylation, Biosynthesis of Urea.

UNIT –III LIPIDS (18 HRS.)

Structure, Properties and classification of lipids; Oxidation of Odd and even chain fatty acids; Ketone bodies: Synthesis and utilization- Biosynthesis of Saturated and Unsaturated Fatty Acids, synthesis of triglycerides – metabolism of Phospholipids and Cholesterol.

UNIT –IV NUCLEIC ACIDS & INTEGRATION OF METABOLISM(18 HRS.)

Nucleic acid structure –Biosynthesis of Purines and Pyrimidines; Biosynthesis of Deoxyribonucleotides – *de novo* and salvage pathways; Degradation of Purine and Pyrimidines; Disorders of Purine metabolism;Integration of Metabolism, Metabolism in Starvation.

UNIT –V ENZYMES AND HORMONE (18 HRS.)

Enzymes – Mechanism of Action – Michaelis - Menton Hypothesis; Factors affecting the Enzyme Action; Enzyme Inhibition; Coenzymes and Isoenzymes. Hormones- Chemical Nature of Hormones – Mechanism of Action; Structure, function and deficiency symptoms of Hormones of Thyroid Gland, Parathyroid Gland, Pancreas, Adrenal Gland and Pituitary Gland**(Self Study).**

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (18 HRS.)

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5. Stryer L.(2003)*Biochemistry, 5th ed.*, W.H.Freeman Publishers, New York.
6. Murray K.R., Granner D.K., Mayer A.P and Rodwell V.W.(2000)*Harper's Biochemistry, 25th ed.*, Appleton and Lange.
7. Devlin M.T.(1997) *Textbook of Biochemistry with Clinical Correlations,* Wiley-Liss Pub, New York.
8. Montgomery R., Conway T.W., Spector A.A and Chapell D. (1996) *Biochemistry – A case oriented approach, 6th ed.,* Mosby Inc., London.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 CARBOHYDRATE				
1.1	Outline classification of Carbohydrate	2	Chalk & Talk	Black Board
1.2	Properties of Carbohydrates	2	Lecture	PPT
1.3	Structure and biological significance of Glucose, Fructose, Lactose, Sucrose, Starch& Glycogen	3	Chalk & Talk	Green Board
1.4	Metabolism and regulation of Glycolysis	2	Lecture	PPT
1.5	Kreb's Cycle, Electron Transport System and Energetics	3	Chalk & Talk	Black Board

1.6	Glycogenesis, Glycogenolysis &Gluconeogenesis,	3	Lecture	Black Board
1.8	HMP Shunt pathway Uronic acid pathway	3	Lecture	LCD
UNIT -2 PROTEINS				
2.1	Structure and classification of amino acids	2	Lecture	Green Board
2.2	General properties of Amino Acids	2	Chalk & Talk	Green Board
2.3	Primary and Secondary structure of Protein	2	Lecture	Smart Board
2.4	Tertiary and Quaternary structure of Protein	3	Lecture	Board
2.5	Ramachandran plot.	2	Lecture	LCD
2.6	Biosynthesis of Amino Acids, Catabolism of Amino acids – Transamination- Deamination- Decarboxylation	5	Chalk & Talk	Black Board
2.7	Biosynthesis of Urea.	2	Chalk & Talk	Black Board
UNIT -3 LIPIDS				
3.1	Structure, Properties and classification of lipids	3	Chalk & Talk	Black Board
3.2	Oxidation of Odd and even chain fatty acids	3	Lecture	LCD
3.3	Ketone bodies: Synthesis and utilization	3	Lecture	LCD
3.4	Biosynthesis of Saturated and Unsaturated Fatty Acids, synthesis of triglycerides	3	Lecture	LCD
3.5	Metabolism of Phospholipids and	3	Lecture	LCD

	Cholesterol.			
UNIT -4 NUCLEIC ACIDS & INTEGRATION OF METABOLISM				
4.1	Nucleic acid structure	2	Chalk & Talk	Black Board
4.2	Biosynthesis of Purines and Pyrimidines; Biosynthesis of Deoxyribonucleotides – de novo and salvage pathways	4	Lecture	LCD
4.3	Degradation of Purine and Pyrimidines	4	Lecture	LCD
4.4	Disorders of Purine metabolism	3	Lecture	PPT
4.5	Integration of Metabolism, Metabolism in Starvation.	3	Lecture	PPT
UNIT - 5 ENZYMES AND HORMONE				
5.1	Enzymes – Introduction and types	2	Chalk & Talk	Black Board
5.2	Mechanism of Action	1	Lecture	Green Board
5.3	Michaelis - Menton Hypothesis; Factors affecting the Enzyme Action	2	Lecture	PPT
5.4	Enzyme Inhibition; Coenzymes and Isoenzymes	3	Lecture	LCD
5.5	Hormones- Chemical Nature of Hormones	1	Discussion	Google classroom
5.6	Structure, function and deficiency symptoms of Hormones of Thyroid Gland	2	Lecture	PPT
5.7	Parathyroid and Pancreas Gland – structure and deficiency syndrome	3	Chalk & Talk	Black Board

5.8	Structure, functions and syndromes of Adrenal Gland and Pituitary Gland	4	Lecture	PPT

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average 5 Mks.	Better of W1, W2 5+5=10 Mks.	M1+M2 15 Mks	MID-SEM TEST 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse

✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Summarize the structure, classification and- metabolic pathways of carbohydrates	K2	PSO1
CO 2	Organize the Structure, Classification and Metabolism of Proteins.	K3	PSO1
CO 3	Explain the structure, classification, synthesis and metabolism of Lipids	K2	PSO1

CO 4	Assess the metabolic pathway of nucleic acid.	K5	PSO1& PSO2
CO 5	Describe the structure, function and mechanism of enzyme and hormone action.	K2	PSO1 & PSO2

COURSE DESIGNER:

1. **Dr. A. Tamil Selvi**
2. **Dr. Antony AmalaJayaseeli**

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG2Z9	Lab in Genetics & Evolution	PG Core	4 Hrs.	2

COURSE DESCRIPTION

This course deals with the laboratory experiments that teach the concepts of inheritance of genes and to explore evolutionary dynamics.

COURSE OBJECTIVE

- Examine the mendelian traits and interpret it.
- Investigates causes and consequences of natural genetic variation within species.
- Interpret the evolutionary changes in allelic frequencies within a population by Hardy-Weinberg law.

GENETICS

1. Study of sex ratio in insects.
2. Preparation of barr bodies from buccal smear.
3. Preparation of giant chromosome in Chironomus larva.
4. Simple mendelian traits.
5. Drosophila culture and observation of phenotypic variations in eye and wing.
6. Pedigree analysis.
7. Shell coiling in *Limnaea* (spotters).
8. Analysis of dominant and recessive traits through beads.
9. Analysis of monohybrid and dihybrid ratio by beads.
10. Assessment of Independent assortment trait through beads.
11. Analysis of Drosophila mutant.

Evolution

1. Study of museum specimens – Evolution of horse, connecting links

2. Mimicry – krait; adaptive colouration - chameleon

3. Study of the skull of vertebrates - Varanus, Crocodile, Bird, Dog, Rabbit/ Rat (Chart/pictures)

4. Calculating gene frequencies and genotype frequencies in the light of Hardy-Weinberg Law through beads.

5. Comparison of forelimbs and hind limbs of vertebrates .

6. Demonstration of natural selection by beads.

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.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
GENETICS				
1.	Study of sex ratio in insects.	4	Demonstration and Hands on training	Insects
2.	Preparation of barr bodies from buccal smear.	4	Demonstration and Hands on training	Cheek cells
3.	Preparation of giant chromosome in Chironomus larva.	4	Demonstration and Hands on training	Chironomous Larva
4.	Simple mendelian traits.	4	Demonstration	
5.	*Drosophila* culture and observation of phenotypic variations in eye and wing.	4	Demonstration and Hands on training	*Drosophila*

6.	Pedigree analysis.	4	Demonstration	
7.	Shell coiling in *Limnaea* (spotters).	4	Explanation	*Limnaea*
8.	Analysis of dominant and recessive traits through beads.	4	Demonstration and Hands on training	Coloured Beads
9.	Analysis of monohybrid and dihybrid ratio by beads.	4	Demonstration and Hands on training	Coloured Beads
10.	Assessment of Independent assortment trait through beads.	4	Demonstration and Hands on training	Coloured Beads
11.	Analysis of *Drosophila* mutant.	4	Demonstration and Hands on training	*Drosophila*
Evolution				
1.	Study of museum specimens – Evolution of horse, connecting links	4	Explanation	Model
2.	Mimicry – krait; adaptive colouration - chameleon	4	Explanation	Specimen
3.	Study of the skull of vertebrates - Varanus, Crocodile, Bird, Dog, Rabbit/ Rat (Chart/pictures)	4	Explanation	Model
4.	Calculating gene frequencies and genotype frequencies in the light of Hardy-Weinberg Law through beads.	4	Explanation	Beads
5.	Comparison of forelimbs and hind limbs of vertebrates .	4	Explanation	Model
6.	Demonstration of natural selection by beads.	4	Explanation	Beads

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session -wise Average 5 Mks.	Better of W1, W2 5+5=10 Mks.	M1+M2 15 Mks	MID-SEM TEST 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Determine the sex in man by Barr bodies.	K4	PSO1
CO 2	Experiment with the simple Mendelian traits.	K3	PSO3
CO 3	Examine the process of Sex determination in man and fruit fly.	K4	PSO1 & PSO2
CO 4	Construct the Pedigree charts by	K3	PSO5 &

	systematic listing of parents.		PSO9
CO 5	Relate the genotypic frequencies by Hardy-Weinberg equilibrium.	K2	PSO2 & PSO9

COURSE DESIGNER:
Dr. X. Devanya Rosaline

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG1Z10	Lab in Biochemistry	Practical	4 Hrs.	2

COURSE DESCRIPTION

Students gain hands-on experience and learn the theoretical basis of lab techniques common to a variety of biological disciplines such as Biochemistry and they will work in groups, learning how to collect, analyze, and present data while using the scientific method to conduct inquiry-based laboratory experiments.

COURSE OBJECTIVES

- Introductory laboratory course in current principles and techniques applicable to research problems in biochemistry and molecular biology.
- Techniques include protein purification and involve identification methods such as centrifugation, chromatography, and electrophoresis; spectrophotometric and enzymatic methods.

EXPERIMENTS

1. Laboratory guidelines
2. Measurement of concentration of solutions using different parameters
3. Preparation of Buffer solutions
4. Determination of the effect of pH on the activity of human salivary amylase
5. Demonstration of the presence of catalase in the given sample
6. Titration of Weak Acid Vs Strong Base and the determination of pKa value
7. Spectrophotometric estimation for verifying Beer's law

8. Spotters: Qualitative analysis of carbohydrates: Molisch's test, Iodine test, Fehling's test, Benedict test, Barfoed's test, Seliwanoff's test, Bial's test, Osazone test

9. Quantitative estimation of carbohydrate by Folin-Wu method

10. Estimation of Protein by Lowry's method

11. Separation of sugars/dyes by thin layer chromatography (TLC).

12. Qualitative analysis of proteins : Precipitation by neutral salt, heavy metals, alchohol, heat coagulation, Biuret test, Ninhydrin test, Xanthoproteic reaction, Pauly's test, Millon's test, Morner's test, Folin phenol test, Aldehyde test, Sakaguchi's test, Sodium nitroprusside test

13. Separation of proteins by SDS PAGE.

14. Protein purification –(i) Precipitation (ii) Gel filtration

15. Determination of Km & Vmax for alkaline phosphatase

16. Estimation of cholesterol by Zak's method.

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. Plummer T.D., (1990) *An Introduction to Practical Biochemistry, 4th ed.*, Mc Graw Hill Book Company, Europe.
6. Palanivelu P., (2004) *Analytical Biochemistry and Separation Techniques – A laboratory manual for B.Sc and M.Sc students, 3rd ed.,* Kalaimani Printers, Madurai.
7. Wilson K and Walker J., (2013) *Principles and Techniques of Biochemistry and Molecular Biology, 7th ed.,* Cambridge University Press, New York.
8. Roe S., (2001) *Protein Purification Techniques – A Practical Approach, 2nd* ed., Oxford University Press.

9. Boyer R., (2000) *Modern Experimental Biochemistry, 3rd ed.,* Pearson Education Inc.
10. Wilson K and Kenneth H.G., (1992) *A Biologists Guide to Principles and Techniques of Practical Biochemistry, 3rd ed.,* Cambridge University Press, Cambridge, UK.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
BIOCHEMISTRY				
1.	Laboratory guidelines	4	Lecture	Black Board/White Board
2.	Measurement of concentration of solutions using different parameters	4	Lecture and Tutorial	Black Board/White Board
3.	Preparation of Buffer solutions	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares
4.	Determination of the effect of pH and temperature on the activity of human salivary amylase	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares
5.	Demonstration of the presence of Catalase in the given sample	4	Lecture &Hands on training	Black Board/White Board/Chemicals/ Glsswares
6.	Titration of Weak Acid *Vs* Strong Base and the determination of pKa value	4	Lecture &Hands on training	Black Board/White Board/Chemicals/ Glsswares
7.	Spectrophotometric	4	Lecture &Hands on	Black Board/White

	estimation of $CuSO_4/K_2Cr_2O_7$ for verifying Beer's law		training	Board/Chemicals/ Glsswares/ Colorimeter
8.	**Spotters:** Qualitative analysis of carbohydrates: Molisch's test, Iodine test, Fehling's test, Benedict test, Barfoed's test, Seliwanoff's test, Bial's test, Osazone test	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares
9.	Quantitative estimation of carbohydrate by Folin-Wu method	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares/ Colorimeter
10.	Estimation of Protein by Lowry's method	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares/ Colorimeter
11.	Separation of sugars/dyes by thin layer chromatography (TLC).	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares/ TLC apparatus
12.	Qualitative analysis of proteins : Precipitation by neutral salt, heavy metals, alchohol, heat coagulation, Biuret test, Ninhydrin test, Xanthoproteic reaction, Pauly's test, Millon's test, Morner's test, Folin	4	Lecture & Hands on training	Black Board/White Board/Chemicals/ Glsswares

	phenol test, Aldehyde test, Sakaguchi's test, Sodium nitroprusside test			
13.	Separation of proteins by SDS PAGE.		Lecture & Demonstration	Black Board/White Board/Chemicals/ Glasswares
14.	Protein purification –(i) Precipitation (ii) Gel filtration		Lecture & Demonstration	Black Board/White Board/Chemicals/ Glasswares
15.	Determination of Km & Vmax for alkaline phosphatase		Lecture & Demonstration	Black Board/White Board/Chemicals/ Glasswares/ Colorimeter
16.	Estimation of Cholesterol by Zak's method		Lecture & Hands on training	Black Board/White Board/Chemicals/ Glasswares/ Colorimeter

EVALUATION PATTERN

Levels	C1 Internal Practical Test 10 Mks	C2 Record 5 Mks.	C3 Model Exam 20		Total Scholastic Marks 35	Non Scholastic Marks C4	CIA Total	% of Assessment
							40Mks.	

K1	**5**	**-**	**-**		**-**		**-**	**-**
K2	**-**	**5**	**4**		**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**		**12**		**12**	**30 %**
K4	**-**	**-**	**3**		**9**		**9**	**22.5%**
Non Scholastic	**-**	**-**	**-**		**9**		**9**	**22.5 %**
Total	**5**	**5**	**10**		**35**	**5**	**40**	**100 %**

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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

NON - SCHOLASTIC		**MARKS**				
C1	**C2**	**C3**	**C4**	**CIA**	**ESE**	**Total**
10	**5**	**20**	**5**	**40**	**60**	**100**

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	Acquire skills in handling basic equipments	K1	PSO4
CO 2	Calculate the strength of unknown solutions using formula	K2	PSO3
CO 3	Estimate the various biomolecules using standard protocols	K3	PSO1
CO 4	Demonstrate experiments adopting appropriate procedures	K2	PSO4& PSO6
CO 5	Critically analyze and interpret the results	K4	PSO4
CO6	Design experiments to solve research problems	K4	PS03&PSO7

COURSE DESIGNER:

1. **Dr. N.Malathi**

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PGZEDC2	Herbal Medicine	PG Core	3 Hrs.	3

COURSE DESCRIPTION

This course deals with the study of medicinal plants and therapeutic values of herbs.

COURSE OBJECTIVES

- To understand the ethnobotanical importance of indigenous medicinal plants and their implications for common ailments.
- To know the key active constituents of the herbal products that are responsible for biological activity.
- Define the importance of nutraceuticals in healthcare.
- To discuss the functional food, herbal supplements and their effects on health.

UNITS

UNIT I: INTRODUCTION (9 HRS.)

History of Herbal medicine - Traditional systems of Medicine – Siddha, Ayurveda, Homeopathy, Unani & Acupuncture - Classification of medicinal plants based on Useful part - Wood, Root, Bark, Leaf & Seed; Usage – Medicinal & Culinary; Active constituents- Aromatic, Astringent - Bitter &Mucilagenous herbs - Doctrines of signature.

UNIT II: COMMON MEDICINAL PLANTS (9 HRS.)

Morphology, Chemical constituents and Medicinal uses of *Aloe vera* (Kumari), *Acalypha indica* (Indian Nettle),*Trigonella foenum-graecum*(Fenugeek), *Cyanodon dactylon* (Bermuda grass),*Vitex negundo* (Chinese chaste tree), *Adathoda vasica* (Malabar Nut), *Piper betel*(Betel leaf),

Curcuma longa (Turmeric), *Azadirachta indica* (Neem), *Andrographis paniculata* (Green chireta), *Emblica officinalis* (Amla), *Piper nigrum* (Pepper).

UNIT III: HERBAL MEDICATION (9 HRS.)

Herbal remedies for common cold – *Ocimum basilicum*(Holy Basil), Renal implication of herbal remedies - *Musa paradisiaca*(Plantain), *Tribulus terrestris*(Puncture vine) - Herbal medicines for Gastro intestinal problems – *Allium sativum* (Garlic), *Zingiber officinale* (Ginger) &*Trachyspermum ammi* (Caraway)- Herbal remedies for Hepatic disorders – *Phyllanthus niruri*(Stonebreaker) , *Eclipta alba* (False daisy)- Herbal remedies for skin diseases – *Holarrhena antidysenterica* (Tellicherry Bark).

UNIT IV: NUTRACEUTICALS AND LIFE STYLE DISORDERS (9 HRS.)

Definition – Nutraceutical and therapeutic value of Medicinal Plants – Nutritional value and uses of *Amarathus dubius*(Greens), *Moringa olerifera* (Drumstick), *Macrotyloma uniflorum*(Horse gram) - Role of Nutraceuticals in Diabetic cure, Management of Obesity, Constipation, Blood pressure.

UNIT V: PREPARATION OF HERBAL PRODUCTS (9 HRS.)

Herbal Face Powder- Bath powder – Herbal hair care: hair conditioner & hair oil - Cough choornam- Anti-diabetic Powder- Triphala choornam – Asthavargha Choornam – Prasava Lehiyam- Health Mix powder - Preparation of Amla candy, Ginger candy, Gulkand & Sherbath.

&Cardiovascular diseases – Female health disorders- Menstrual problems.

REFERENCE BOOKS:

1. Schulz V, Haensel R and Tyler V.E., Rational Phytotherapy, A Physicians Guide to Herbal Medicine, Springer Publishers, Berlin.
2. McKenna D.J., Jones K. and Hughes K., Botanical Medicines, The Desk Reference for Major Herbal Supplements, The Haworth Herbal Press, New York.
3. Natural Medicines Comprehensive Database.
4. Maeilanandhan, S.K.M., (2010*). Siddha and Ayuveda* -Therapeutic Index-Siddha, Sri Lakshmi chirtaprinters,.

CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1INTRODUCTION				
1.1	History of Herbal medicine.	2	Chalk & Talk	Black Board
1.2	Traditional systems of Medicine – Siddha, Ayurveda, Homeopathy, Unani & Acupuncture.	2	Chalk & Talk	LCD
1.3	Classification of medicinal plants based on Useful part - Wood, Root, Bark, Leaf & Seed.	3	Lecture	PPT & White board
1.4	Usage – Medicinal & Culinary; Active constituents- Aromatic, Astringent - Bitter &Mucilagenous herbs.	1	Lecture	Black Board
1.5	Doctrines of signature.	1	Lecture	Black Board
UNIT -2 COMMON MEDICINAL PLANTS				
2.1	Morphology, Chemical constituents and Medicinal uses of *Aloe vera* (Kumari),	1	Lecture	Black Board
2.2	*Acalypha indica* (Indian Nettle),*Trigonella foenum-graecum* (Fenugeek), *Cyanodon dactylon* (Bermuda grass),)	2	Chalk & Talk	Black Board
2.3	*Vitex negundo* (Chinese chaste tree), *Adathoda vasica* (Malabar Nut),	2	Chalk & Talk	Black Board
2.4	*Curcuma longa* (Turmeric), *Azadirachta indica* (Neem)	2	Chalk & Talk	Black Board
2.5	*Azadirachta indica* (Neem), *Andrographis paniculata*	2	Lecture	White board

	(Green chireta), *Emblica officinalis* (Amla), *Piper nigrum* (Pepper).			
UNIT -III HERBAL MEDICATION				
3.1	Herbal remedies for common cold – *Ocimum basilicum*(Holy Basil)	1	Chalk & Talk	Black Board
3.2	Renal implication of herbal remedies - *Musa paradisiacal* (Plantain), *Tribulus terrestris*(Puncture vine)	2	Chalk & Talk	Black Board
3.3	Herbal medicines for Gastro intestinal problems – *Allium sativum* (Garlic), *Zingiber officinale* (Ginger) &*Trachyspermum ammi* (Ajowan caraway)	2	Lecture	White board
3.4	Herbal remedies for Hepatic disorders – *Phyllanthus niruri*(Bahupatra) *, Eclipta alba* (Bringha raj)	2	Lecture	Black Board
3.5	Herbal remedies for skin diseases – *Holarrhena antidysenterica* (Tellicherry bark).	2	Lecture	Black Board
Unit-IV NUTRACEUTICALS AND LIFE STYLE DISORDERS				
4.1	Definition – Nutraceutical and therapeutic value of Medicinal Plants	2	Chalk & Talk	Black Board
4.2	Physical Properties, Nutritional value and uses of *Amarathus dubius* spp.(Greens)	1	Chalk & Talk	Black Board
4.3	*Moringa olerifera* (Drumstick), *Macrotyloma uniflorum*(Horse gram)	2	Lecture	White board

4.4	Role of Nutraceuticals in Diabetic cure, Management of Obesity, Constipation.	2	Lecture	Black Board
4.5	Blood pressure & Cardiovascular diseases – Female health disorders.	2	Lecture	Black Board
UNIT –V PREPARATION OF HERBAL PRODUCTS				
5.1	Herbal Face Powder- Bath powder – Herbal hair care: hair conditioner & hair oil	2	Demonstrations	Raw Material
5.2	Cough choornam- Anti-diabetic Powder- Triphala choornam – Asthavargha Choornam	2	Demonstrations	Raw Material
5.3	Prasava Lehiyam- Health Mix powder	1	Demonstrations	Raw Material
5.4	Preparation of Amla candy, Ginger candy,	2	Demonstrations	Raw Material
5.5	Gulkand & Sherbath	1	Demonstrations	Raw Material
5.6	Cardiovascular diseases – Female health disorders- Menstrual problems.	1	Chalk & Talk	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Session -wise Average	**Better of W1, W2**	**M1+M2**	**MID-SEM TEST**				
	5 Mks.	**5+5=10 Mks.**	**15 Mks**	**5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5**

								%
K3	-	-	**3**	**5**	**12**		**12**	**30 %**
K4	-	-	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Make use of alternative medicinal methods.	K3	PSO1& PSO2
CO 2	Infer the importance of herbs used in day today life.	K2	PSO3
CO 3	Categorize the usage of herbs for different ailments.	K4	PSO4
CO 4	Solve the life style disorders with food supplements.	K3	PSO12
CO 5	Prepare various herbal products.	K3	PSO 10& PSO12

COURSE DESIGNER:
Dr. X. Devanya Rosaline

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**-**	**Computer Applications For Biologists**	**Add on Course**	**40 Hrs.**	**4**

COURSE DESCRIPTION

It provides hands on experience on the tools and techniques of bioinformatic sequence analysis. It begins with the data storage in major biological databases, retrieval of sequences and bioinformatics tools used for pairwise and multiple sequence alignment.

COURSE OBJECTIVES

To gain skills on *in silico* data analysis and protein structure prediction

COURSE CONTENT

1. Statistical analysis with MS-EXCEL
2. Biological databases – NCBI, UniProt
3. Sequence retrieval from biological databases
4. Sequence similarity analysis – BLAST, FastA,
5. Multiple sequence alignment - ClustalO
6. Phylogenetic analysis – MEGA6
7. Protein Structure visualization – PDB, Rasmol
8. Homology modeling - SWISSPDB Viewer

REFERENCES:

1. Khan I.A and Khanum A., (2004). *Fundamentals & Biostatistics*, 2nd ed., Ukaaz Publications, Hyderabad.
2. Banerjee P.K., (2006). *Introduction to Biostatistics*, 3rd ed., S.Chand Publication, New Delhi.
3. Misra B.N and Misra M.K., (1983). *Introduction to Practical Biostatistics*, Naya Prokash, Calcutta,.
4. Baxevanis D and Francis B.F., (2004). *Bioinformatics – A Practical Guide to the Analysis of Genes and Proteins*, 3rd ed., John Wiley & Sons Inc.
5. Attwood T.K and Parrysmith D.J., (2005). *Introduction to Bioinformatics*, Pearson Education.
6. Campbell M.A and Heyer L.J., (2004). *Discovering Genomics*, Proteomics and Bioinformatics, Pearson Education.
7. Gibson G and Muse S.V., (2002). *A Primer of Genomic Science*, Sinauer Associates Inc. Pub., Sunderland.
8. Jones N.C and Pevzner P.A., (2005). *An Introduction to Bioinformatics Algorithms*, Ane Books, New Delhi.
9. Lesk M., (2004). *Introduction to Bioinformatics*, Oxford University Press.
10. Bergeron B.M.D., (2003). *Bioinformatics Computing – The Complete Practical Guide to Bioinformatics for Life Scientists*, Pearson Education (Singapore) Pvt. Ltd., Delhi.
11. Rastogi P.S.C., Namita M and Rastogi P., (2004). *Bioinformatics Concepts, Skills and Applications*, CBS Publishers, New Delhi..

WEB REFERNCES:

1. www.ncbi.nlm.nih.gov
2. www.uniprot.org
3. www.rcsb.org
4. https://prosite.expasy.org
5. www.ncbi.nlm.nih.gov/blast/
6. www.ebi.ac.uk/Tools/msa/clustalo
7. www.megasoftware.net/
8. https://spdbv.vital-it.ch/
9. www.autodock.scripps.edu/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**TITLE**			
1.1	Statistical analysis with MS-EXCEL	5	Chalk & Talk	Black Board
1.2	Biological databases – NCBI, UniProt	5	Chalk & Talk	LCD
1.3	Sequence retrieval from biological databases	5	Lecture	PPT & White board
1.4	Sequence similarity analysis – BLAST, FastA	5	Lecture	Smart Board
1.5	Multiple sequence alignment - ClustalO	5	Lecture	Black Board
1.6	Phylogenetic analysis – MEGA6	5	Discussion	Google classroom
1.7	Protein Structure visualization – PDB, Rasmol	5	Specimen	Microscope
1.8	Homology modeling - SWISSPDB Viewer	5	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %

K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Apply MS-EXCEL for statistical analysis	K3	PSO1& PSO11
CO 2	Retrieve nucleotide, protein sequences and protein structure	K1	PSO11
CO 3	Perform BLAST and FastA	K2	PSO11
CO 4	Interpret the results obtained through bioinformatic tools	K3	PSO1 & PSO11
CO 5	Model protein structure using Swisspdb viewer	K4	PSO11
CO 6	Illustrate the biological interactions of target protein and drugs	K2	PSO11

COURSE DESIGNER:

Dr. J. Asnet Mary

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2019 onwards

(for Zoology, Home science students)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**-**	**SPSS**	**Add on Course**	**40 Hrs.**	**4**

COURSE DESCRIPTION

It provides hands on experience on the tools and techniques of SPSS statistical package.

COURSE OBJECTIVES

To gain skills on analysis of data and interpretation using SPSS software

COURSE CONTENT

1. Introduction to Research Methodology- Testing Hypothesis
2. Data Entry in SPSS through Questionnaire, Importing Data
3. Charting with SPSS- explore, PP plots and QQ Plots and Interpretations
4. Descriptive analysis – Measures of Central Tendency, Kurtosis, Skewness
5. One Sample t test – Independent and Paired sample t test
6. Correlation – Pearson - Regression analysis– Simple Linear, R square
7. Factorial ANOVA, F- Statistics and p values
8. Hierarchical Clustering with SPSS -Interpretation and Report Writing

REERENCES

1. Ajaj S.G and Sanjaya S. G., (2009).*Statistical Methods for Practice and Research:* A Guide to Data Analysis Using SPSS (Response Books) 2nd Edition, Kindle Edition. Sage Publications Pvt. Ltd; 2 edition (13 May 2009)
2. Kiran P., Smruti B and Sanjay S., (2011).*SPSS in Simple Steps Paperback.*
3. George D., Mallery P., English N.A., George D and Mallery P., (2016). *IBM SPSS Statistics 23 Step by Step*: A Simple Guide and Reference.
4. Kayyanaraman K.,Hareesh N.R and Harikumar P.N., (2016).*Statistical Methods for Research*: A Step by Step Approach Using IBM SPSS Hardcover – Atlantic Publications.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.spss-tutorials.com/basics/
2. https://www.udemy.com/course/spss-statistics-foundation-course-from-scratch-to-advanced/
3. https://www.open.edu/openlearn/society-politics-law/sociology/getting-started-spss/content-section-

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
SPSS OFF CLASS				
1.1	Introduction to Research Methodology- Testing Hypothesis	5	Chalk & Talk	Black Board
1.2	Data Entry in SPSS through Questionnaire, Importing Data	5	Demonstration	LCD
1.3	Charting with SPSS- explore, PP plots and QQ Plots and Interpretations	5	Lecture	LCD
1.4	Descriptive analysis – Measures of Central Tendency, Kurtosis,	5	Lecture	Smart Board

	Skewness			
1.5	One Sample t test – Independent and Paired sample t test	5	Lecture	LCD
1.6	Correlation – Pearson - Regression analysis– Simple Linear, R square	5	Software	LCD
1.7	Factorial ANOVA, F-Statistics and p values	5	SPSS software	LCD
1.8	Hierarchical Clustering with SPSS -Interpretation and Report Writing	5	Software	LCD

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Apply the knowledge of research methodology and frame the hypothesis	K3	PSO1, PSO5

CO 2	Explains the features of questionnaire	K1	PSO1, PSO%, PSO9
CO 3	Perform Student's t test and ANOVA	K2	PSO3
CO 4	Interpret the results obtained through SPSS analysis tools	K3	PSo9 & PSO11
CO 5	Analyse the data SPSS	K4	PSO11
CO 6	Performs Hierarchical Clustering using SPSS software	K2	PSO11

COURSE DESIGNER:

Dr. N.Nagarani

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3Z11	Biophysics	PG Core	6	5

COURSE DESCRIPTION

Biophysics which is an inter disciplinary course, deals with the discipline concerned with the application of the principles and methods of physics and the other physical sciences to the solution of biological problems.

COURSE OBJECTIVES

- To imbibe the principles of physics involved in the structure elucidation of biomolecules
- To understand the principles of energy transformation in living systems
- To apply the use of modern physical instruments to unravel the importance of therapeutic radiology, in which the measurement of dose is critical to treatment, and in diagnostic radiology, particularly with techniques involving isotopes

UNITS:

UNIT-I: CHEMCAL BONDS AND MOLECULAR INTERACTIONS [15 HRS.]

Electron configuration of an atom: Covalent bond, hydrogen bond, Disulphide bond, Peptide bonds- Forces between Molecules: Electrostatic force, Van der Waal's forces, hydrophobic and hydrophilic - Biological importance and domains of Physics in Biology-Electrolytic dissociation and electrolytes:- Ionisation, Basis of acidity and Basicity, Bronsted Lowry theory, strength of acids and bases, Henderson and Hasselbalch equation. Water as Dipole -Biological importance of water

Self-Study:-Water as Dipole -Biological importance of water,Electron configuration of an atom: Covalent bond, hydrogen bond, Disulphide bond, Peptide bonds- Forces between Molecules: Electrostatic force, Van der Waal's forces, hydrophobic and hydrophilic

UNIT-II: THERMODYNAMICS AND BIOLOGICAL OXIDATION [15 HRS.]

Laws of Thermodynamics: Concept of free energy and entropy, Exergonic and Endergonic reactions, Rate of reactions - Effect of sunlight and temperature on reactions - Energy of Activation: Arrhenius expression, Diffusion: Fick's Laws-I & II law, constant laws, Osmotic coefficient: Gibbs Donnan equilibrium- Oxidation and reduction reactions: Redox potentials in biological system- High energy phosphate group : ATP synthesis in mitochondria, ATP synthase.

UNIT-III: INSTRUMENTATION [15 HRS.]

Principle, Components and Biological applications of Light microscope, Polarising microscope, Inverted microscope, Confocal and X-ray microscope, Flow cytometry - Colorimetry and Spectrophotometry: Laws of absorption, complementary colours, Chromophore concept, Absorption spectrum, Wavelength selectors, Detection devices, amplification and read out. Chromatography: Paper chromatography, TLC and Column chromatography. Centrifugation: Principle, Types & Applications, Relative Centrifugal Force, Factors affecting sedimentation and types of centrifugation

UNIT-IV: PHOTO BIOPHYSICS [15 HRS.]

Electromagnetic spectrum: Components of EMR, Quantum theory of radiation, Biological application, Effects of UV on Biological systems - Radioactive isotopes: Measurements of radiation, Dosimetry, Cerenkov radiation, Interaction of radioactivity with matter, Gas ionization methods: Ionization chambers, proportional counters, GM tubes, Photographic methods: Autoradiography, Excitation method: Liquid Scintillation counters; Use of isotopes as tracers in Biology; Safety aspects

Self-Study:-Use of isotopes as tracers in Biology; Safety aspects, Effects of UV on Biological systems

UNIT-V: BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY [15 HRS.]

Biophysical aspects of vision: photoreceptors :simple and compound, structure and function of vertebrate eye, mechanism of conversion of light stimulation to neuronal impulse - Nerve conduction: Neurotransmitters and Synapse, Nerve impulse, membrane potential, resting potential and action potential, Action potentials in earthworm nerve fiber - Muscle contraction

Self-Study:-Neurotransmitters and Synapse

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

REFERENCES:

1. Claycomb J.J, Tran J.Q.P., (2011) *Introductory Biophysics: Perspectives on the living state, Jones and Bartlett publishers*, New Delhi.
2. Upadhyay A, Upadhyay K and Nath N., (2007) *Biophysical chemistry Principles and Techniques, Himalaya Publishing House Pvt.* Ltd., Mumbai.
3. Narayanan P, (2007) *Essentials of Biophysics, New Age International (P) Ltd.,* Publishers, New Delhi.
4. Nolting B., (2005) *Methods in modern Biophysics, Springer (India) private Ltd.,* New Delhi.
5. Cotterill R., (2004) *Biophysics and Introduction, John Wiley and Sons* Ltd., printed in India by Replika press pvt. Ltd., Kundli
6. Agarwal S.K., (2005) *Advanced Biophysics, APH publishing corporation,* New Delhi.
7. Pattabhi V and Gautham N., (2004) *Biophysics*, Narosa Publishing House, New Delhi.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 CHEMCAL BONDS AND MOLECULAR INTERACTIONS				
1.1	Electron configuration of an atom: Covalent bond, hydrogen bond, Disulphide bond, Peptide bonds-	2	Discussion	Black Board
1.2	Forces between Molecules: Electrostatic force, Van der Waal's forces, hydrophobic and hydrophilic	2	Chalk & Talk	LCD
1.3	Biological importance and domains of Physics in Biology	2	Lecture	PPT & White board
1.4	Electrolytic dissociation and electrolytes:- Ionisation, Basis of acidity and Basicity,	3	Lecture	Smart Board
1.5	Bronsted Lowry theory, strength of acids and bases,	2	Lecture	Black Board
1.6	Henderson and Hasselbalch equation.	1	Chalk & Talk Discussion	Google classroom
1.7	Water as Dipole -Biological importance of water	3	Lecture	Black Board
UNIT-II: THERMODYNAMICS AND BIOLOGICAL OXIDATION				
2.1	Laws of Thermodynamics: Concept of free energy	2	Lecture	Green Board Charts
2.2	Entropy, Exergonic and Endergonic reactions,	2	Chalk & Talk	Green Board
2.3	Rate of reactions - Effect of sunlight and temperature on reactions	2	Discussion	Black Board
2.4	Energy of Activation: Arrhenius expression	1	Chalk & Talk	Green Board
2.5	Diffusion: Fick's Laws-I & II law,	2	Lecture	PPT &

				White board
2.6	constant laws, Osmotic coefficient	1	Lecture	Smart Board
2.7	Gibbs Donnan equilibrium-	2	Lecture	Black Board
2.8	Oxidation and reduction reactions: Redox potentials in biological system	1	Chalk & Talk Discussion	Google classroom
2.9	High energy phosphate group : ATP synthesis in mitochondria, ATP synthase.	2	Lecture	Black Board
UNIT-III: INSTRUMENTATION				
3.1	Principle, Components and Biological applications of Light microscope	1	Chalk & Talk	Black Board
3.2	Principle, Components and Biological applications of Polarising microscope	1	Chalk & Talk	LCD
3.3	Principle, Components and Biological applications of Inverted microscope	1	Lecture	PPT & White board
3.4	Principle, Components and Biological applications of Confocal microscope	1	Lecture	Smart Board
3.5	Principle, Components and Biological applications of X-ray microscope	1	Lecture	Black Board
3.6	Flow cytometry	1	Discussion	Google classroom
3.7	Colorimetry and Spectrophotometry: Laws of absorption, complementary colours	2	Lecture	Black Board
3.7	Chromophore concept, Absorption spectrum, Wavelength selectors, Detection devices, amplification and read out	2	Lecture	Black Board
3.8	Chromatography: Paper chromatography	1	Lecture	Black Board

3.9	TLC	1	Lecture	PPT & White board
3.10	Column chromatography	1	Lecture	PPT & White board
3.11	Centrifugation: Principle, Types & Applications, Relative Centrifugal Force	1	Lecture	PPT & White board
3.12	Factors affecting sedimentation and types of centrifugation	1	Chalk & Talk	Green Board
UNIT-IV: PHOTO BIOPHYSICS				
4.1	Electromagnetic spectrum: Components of EMR	1	Chalk & Talk	Black Board
4.2	Quantum theory of radiation	2	Chalk &Talk	LCD
4.3	Biological application	2	Lecture	PPT & White board
4.4	Effects of UV on Biological systems	1	Lecture	Smart Board
4.5	Radioactive isotopes: Measurements of radiation, Dosimetry	2	Lecture	Black Board
4.6	Cerenkov radiation and Interaction of radioactivity with matter	1	Discussio n	Google classroom
4.7	Gas ionization methods: Ionization chambers, proportional counters, GM tubes	2	Lecture	Black Board
4.7	Photographic methods: Autoradiography,	2	Lecture	Black Board
4.8	Excitation method: Liquid Scintillation counters	1	Lecture	Black Board
4.9	Use of isotopes as tracers in Biology; Safety aspects	1	Lecture	Black Board
UNIT-V: BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY				
5.1	Biophysical aspects of vision: photoreceptors :simple and	2	Chalk & Talk	Black Board

	compound			
5.2	structure and function of vertebrate eye,	2	Chalk & Talk	LCD
5.3	mechanism of conversion of light stimulation to neuronal impulse	2	Lecture	PPT & White board
5.4	Nerve conduction: Neurotransmitters and Synapse	3	Lecture	Smart Board
5.5	membrane potential, resting potential and action potential,	2	Lecture	Black Board
5.6	Action potentials in earthworm nerve fiber	2	Discussion	Google classroom
5.7	Muscle Contraction	2	Lecture	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Session - wise Average 5 Mks.	**Better of W1, W2 5+5=10 Mks.**	**M1+M2 15 Mks**	**MID-SEM TEST 5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Once in Semester/Seminar

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non – Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE	PSOs

		LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	ADDRESSED
CO 1	Classify the chemical bonds and forces interacting between molecules	K2	PSO1& PSO2
CO 2	Summarize the theories involved in acidity and basicity	K2	PSO2
CO 3	Explain the principles of Thermodynamics and biological oxidation	K1	PSO1
CO 4	Describe the principle, procedure, components involved and biological applications of Instruments	K1	PSO4
CO 5	Apply the principles of Photobiology in the Perception and Chemical Processing of Vision	K3	PSO1 & PSO2
CO 6	Assess the principles, properties applications and hazardous nature of Radioactive isotopes	K3	PSO1
CO 7	Interpret the Biophysical aspects of neurophysiology applied to the Animals	K2	PSO2
CO 8	Organize the Biological importance and various domain of physics in Biology in the form of flow chart	K4	PSO2 & PS10

COURSE DESIGNER:

1. **Dr.N.MALATHI**

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3Z12	Immunology	PG Core	90 Hrs.	5

COURSE DESCRIPTION

The course intends to provide the biology of immune system and mechanism of immune response, maturation of lymphocytes and major histocompatibility complex and immune system related disorders and vaccines.

COURSE OBJECTIVES

To understand the functions of immune system and to envisage the different immune response in human health.

UNITS

UNIT –I OVERVIEW OF THE IMMUNE SYSTEM (15 HRS.)

Historical perspective (Overview) - Innate (Nonspecific) and adaptive (Specific) immunity – Cells of the immune system: B-lymphcytes, T lymphocytes, mononuclear cells, granulocytic cells (Neutrophils, Eosinophils, Basophils), Mast cells, Dendritic cells – Primary lymphoid organs: Thymus, Bone marrow, Lymphatic system – Secondary lymphoid organs: Lymph nodes, spleen, MALT, Bursa of Fabricius. Primary immune response and secondary immune response.

Self-study – Secondary lymphoid organs

UNIT –II ANTIGENS AND ANTIBODIES (15 HRS.)

Antigen-structure and properties, Haptens, Adjuvants, Epitopes: B cell epitope and T cell epitope. **Antibody**: Immunoglobulin - structure, classes biological functions. Characteristics - Isotypes - Allotypes - Idiotypes - Immunoglobulin super family, monoclonal and polyclonal antibodies.

Organization and rearrangement of light-chain genes (κ & λ chain) and Heavy chain genes - Antigen–Antibody interactions, Immunodiffusion and immunoelectrophoresis. Agglutination, Precipitation, Hybridoma Technology.

Self-study - B cell epitopes and T cell epitopes.

UNIT –III LYMPHOCYTES MATURATION AND ACTIVATION & MHC (15 HRS.)

B-cell maturation – B cell activation and proliferation - affinity maturation – class switching – generation of plasma cells and memory B cells - General organization and inheritance of MHC – MHC Genes - Structure of MHC molecules – Class I & II - Processing and presentation of exogenous and endogenous antigens - Tissue typing - T-cell maturation: Thymic selection – T cell activation – T cell differentiation.

Self-study - Structure of MHC molecules – Class I & II

UNIT –IV COMPLEMENT SYSTEM AND HYPERSENSITIVITY (15 HRS.)

Complement activation pathways: Classical, Alternate and Lectin - Regulation of complement system - Biological consequences of complement activation - Complement deficiencies. Hypersensitive reactions – IgE mediated (Type I) Hypersensitivity: components, mechanism, mediators and consequences – Antibody mediated cytotoxic hypersensitivity (Type II) – Immune complex mediated Types III hypersensitivity and T_{DTH} mediated Type IV hypersensitivity.

Self-study - Biological consequences of complement activation

UNIT –V VACCINE AND IMMUNITY IN HEALTH AND DISEASE (15 HRS.)

Vaccines: Whole organism vaccines, Purified macromolecules as Vaccines, Recombinant vector vaccines, Synthetic peptide vaccines, Multivalent subunit vaccines. Immune response and immune evasion during bacterial (Tuberculosis), Parasitic (Malaria) and viral (HIV) infections. Congenital immunodeficiency diseases (SCID and Ataxia). Autoimmunity: Organ-specific autoimmune diseases. Systemic auto-immune diseases.

Self-study - Congenital immunodeficiency diseases

REFERENCES:

1. Owen J, Punt J, Stranford S.A. (2013). *Kuby Immunology*. 7th ed., Macmillan, International Ed..
2. Rao C.V. (2007). *A text book of Immunology*, 3rd ed., Narosa Publishing House, New Delhi.
3. Parham P. (2014). *The Immune System*, Fourth Edition, Garland Science Publisher, USA.
4. Chakravarthy A.K. (2003). *Immunology*, 2nd ed., N.L. Publishers. Siliguri.
5. Lydyard P.M, Whelan A, Fanger M.W. (2003). *Instant notes on Immunology*. Viva Books Private Limited. New Delhi.
6. Clark W.R. (1991). *The experimental foundations of modern Immunology*, 4th ed., John Wiley and Sons, INC.
7. Roitt I.M. (1988). *Essential Immunology*, 6th ed., English Language Book Society/ Blackwell Scientific Publications.
8. Emil R. U., Benacerraf B. (1984). *Text book of Immunology*, 2nd Ed., Williams and Wilkins, Baltimore, London.
9. Mc Connell, Munro A, Waldmann H. (1984). *The Immune System*, 2nd Ed., Blackwell Scientific Publication.
10. Hyde R.M. (1977). *Immunology*, 3rd Ed., B.I.W. Waverly Pvt Ltd New Delhi.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 OVERVIEW OF THE IMMUNE SYSTEM				
1.1	Historical perspective (Overview)	1	Discussion	Black Board
1.2	Innate (Nonspecific) immunity	1	Chalk & Talk	LCD
1.3	adaptive (Specific) immunity	1	Lecture	PPT & White board
1.4	Cells of the immune system: B-lymphcytes, T lymphocytes,	1	Lecture	Smart Board

	mononuclear cells,			
1.5	granulocytic cells (Neutrophils, Eosinophils, Basophils), Mast cells, Dendritic cells	1	Lecture	Black Board
1.6	Primary lymphoid organs: Thymus	1	Chalk & Talk Discussio n	Google classroom
1.7	Bone marrow, Lymphatic system	2	Lecture	Black Board
1.8	Secondary lymphoid organs: Lymph nodes,	1	Discussio n	Black Board
1.9	Spleen, MALT, Bursa of Fabricius.	1	Lecture	Black Board
1.10	Primary immune response and secondary immune response		Lecture	Black Board
UNIT -2 ANTIGENS AND ANTIBODIES				
2.1	**Antigen**-structure and	1	Lecture	Green Board Charts
2.2	Properties of antigen, Haptens, Adjuvants,	2	Chalk & Talk	Green Board
2.3	B cell epitopes – Properties	1	Discussio n	Black Board
2.4	T cell epitope – Properties	1	Chalk & Talk	LCD
2.5	Immunoglobulin - structure,	1	Lecture	PPT & White board
2.6	classes of Ig – Structure and biological functions of IgG.	1	Lecture	Smart Board
2.7	Structure and biological functions of IgA, IgM	1	Lecture	Black Board
2.8	Structure and biological functions of IgD and IgE	1	Chalk & Talk Discussio n	Google classroom
2.9	Characteristics - Isotypes - Allotypes - Idiotypes - Immunoglobulin super family,	1	Lecture	Black Board
2.10	monoclonal and polyclonal antibodies. – Hybridoma Technology – Method	1	Discussio n	Black Board
2.11	Hybridoma Technology applications	1	Lecture	Black Board
2.12	Organization and rearrangement of light-chain genes (κ & λ chain	1	Lecture	Black Board

2.13	Organization and rearrangement of Heavy chain genes	1	Lecture	Black Board
2.14	Antigen–Antibody interactions, Immunodiffusio n Agglutination, Precipitation	1	Lecture	Black Board
2.15	immunoelectrophoresis.	1	Lecture	Black Board
2.16	B cell epitopes – Properties	1	Discussio n	Black Board
2.17	T cell epitope – Properties	1	Chalk & Talk	LCD
UNIT -3 LYMPHOCYTES MATURATION AND ACTIVATION & MHC				
3.1	B-cell maturation& B cell activation	3	Chalk & Talk	Black Board
3.2	B- Cell proliferation, affinity maturation – class switching	3	Chalk & Talk	LCD
3.3	generation of plasma cells and memory B cells	1	Lecture	PPT & White board
3.4	MHC Genes - Structure of MHC molecules – Class I & II	2	Lecture	Smart Board
3.5	Processing and presentation of exogenous antigens	1	Lecture	Black Board
3.6	Processing and presentation of endogenous antigens	1	Discussio n	Google classroom
3.7	Tissue typing	1	Lecture	Black Board
3.7	T-cell maturation	2	Lecture	Black Board
3.8	Thymic selection – T cell activation - T cell differentiation	1	Lecture	Black Board
UNIT -4 COMPLEMENT SYSTEM AND HYPERSENSITIVITY				
4.1	Complement activation pathways: Classical	1	Chalk & Talk	Black Board
4.2	Complement activation pathways: Alternate	2	Chalk & Talk	LCD
4.3	Lectin pathways	2	Lecture	PPT & White board
4.4	Regulation of complement system	1	Lecture	Smart Board
4.5	Biological consequences of complement activation	2	Lecture	Black Board
4.6	Complement deficiencies	1	Discussio n	Google classroom
4.7	Hypersensitive reactions – IgE mediated (Type I) Hypersensitivity	2	Lecture	Black Board

4.7	Antibody mediated cytotoxic hypersensitivity	2	Lecture	Black Board
4.8	Immune complex mediated Types III hypersensitivity	1	Lecture	Black Board
4.9	T_{DTH} mediated Type IV hypersensitivity	1	Lecture	Black Board
UNIT -5 VACCINE AND IMMUNITY IN HEALTH AND DISEASE				
5.1	Vaccines: Whole organism vaccines, - Heat killed vaccines, Attenuated vaccines	2	Chalk & Talk	Black Board
5.2	Purified macromolecules as Vaccines, Recombinant vector vaccines,	3	Chalk & Talk	LCD
5.3	Synthetic peptide vaccines, Multivalent subunit vaccines.	2	Lecture	PPT & White board
5.4	Immune response and immune evasion during bacterial (Tuberculosis),	1	Lecture	Smart Board
5.5	Parasitic (Malaria)	1	Lecture	Black Board
5.6	viral (HIV) infection	1	Discussion	Google classroom
5.7	Congenital immunodeficiency diseases (SCID and Ataxia).	2	Lecture	Black Board
5.8	Autoimmunity, Organ- specific autoimmune diseases, Systemic auto-immune diseases	3	Discussion	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %

K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Once in Semester/Seminar

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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 innate and adaptive immunity	K4	PSO1& PSO2
CO 2	Describe the structure and functions of immune cells and lymphoid organs	K1	PSO2
CO 3	List the properties of B and T cell epitopes	K1	PSO1
CO 4	Discuss the structure, types and properties of various Immunoglobulins	K2	PSO9
CO 5	Differentiate the gene organization and molecular structures of MHC class I and class II	K4	PSO1 & PSO2
CO 6	Discuss the activation and maturation of B-cells and T-cells	K2	PSO1
CO 7	Relate immunoglobulins and biological consequences of complement activation	K3	PSO2
CO 8	Summarize the methods, merits and demerits of different types of vaccines	K2	PSO2 & PSO5
CO 9	Explain the immune response to infectious diseases	K2	PSO5

COURSE DESIGNER:

1. **Dr. J. Asnet Mary**

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.

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**
	Session -wise Average 5 Mks.	**Better of W1, W2 5+5=10 Mks.**	**M1+M2 15 Mks**	**MID-SEM TEST 5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Find the measures of central tendency and dispersion values	K1	PSO3
CO 2	Assess the difference between the expected and observed frequencies by Chi-Square test	K3	PSO2
CO 3	Compute degrees of relationship between two variables with reference to correlation and regression	K2	PSO5
CO 4	Test the hypothesis of mean of the variables whether significant or not through ANOVA	K4	PSO5 & PSO9
CO 5	Identify the research problem and generation of raw data through different methods	K1	PSO1, PSO3 & PSO7
CO 6	Apply the statistical tools to calculate the data	K3	PSO9 & PSO11
CO 7	Tabulate the research data in appropriate order	K2	PSO5
CO 8	Interpret the results and draw conclusion	K4	PSO5
CO 9	Outline the steps in drafting the thesis	K2	PSO5
CO1	Formulate the research work through documentation	K3	PSO6& PSO11

COURSE DESIGNER:
Dr. X. Devanya Rosaline

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3ZE1	Fisheries & Aquaculture	Elective Core	4Hrs.	4

COURSE DESCRIPTION

This Course focuses on Fisheries and Aquaculture of Finfishes, Marine Prawn, Pearl Oyster and Disease Management.

COURSE OBJECTIVES

To impart knowledge on Fisheries and Aquaculture Practices in India.

UNIT I - INDIAN CAPTURE FISHERIES (15 HRS)

History of Fisheries, Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries; Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries

UNIT II - AQUACULTURE PRACTICES (15 HRS)

Preparation and Construction of Ponds; Water Quality Management; Maintenance of Fish Farms; Fish Nutrition – Live feed, Artificial feed - FCR; Induced Breeding – Eyestalk ablation and Hypophysation.

UNIT III - CULTURE SYSTEMS (15 HRS)

Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber - Sewage fed fish culture, Integrated Fish Farming.

UNIT IV - FISH PATHOLOGY AND POST HARVEST TECHNOLOGY (15 HRS)

Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases; Preservation of Fish; Fish Marketing

UNIT V - INDIAN FISHERY (15 HRS)

Indian Fish Geography, Fishing Gears and Methods, Fishing Crafts; Indian Exclusive Economic Zone – Use of Remote Sensing and GIS.Role of Government and Public Sector on Indian Fisheries, FFDAs.

REFERENCE BOOKS:

1. Pandey K. and Shukla J.P., (2012) *Fish and Fisheries*, 3rd Revised ed., Rastogi Publications, Meerut.

2. Srivastava C.B.L., (2008) *A Textbook of Fishery Science and Indian Fisheries*, 3rd Revised ed., Published by KitabMahal, Allahabad.

3. Kumar R., (2012) *Fish Farming Management*, 1st ed., Arise Publishers and Distributors, New Delhi.

4. Chandrasekhar Y.S., (2013) *Fish Nutrition in Aquaculture*, 1st ed., Swastik Publications, New Delhi.

5. Reddy S.M. and Sambasiva Rao K.R.S., (1999) *A Textbook of Aquaculture*, Discovery Publishing House, New Delhi.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT I: INDIAN CAPTURE FISHERIES				
1.1	History of Fisheries	2	Chalk & Talk	Black Board
1.2	Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries	7	Chalk & Talk	LCD
1.3	Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries	5	Lecture	PPT & White board
UNIT II AQUACULTURE PRACTICES				
2.1	Preparation and Construction of Ponds	4	Lecture	Charts
2.2	Water Quality Management	2	Chalk & Talk	PPT& Videos
2.3	Maintenance of Fish Farms	2	Chalk & Talk	PPT

2.4	Fish Nutrition – Live feed, Artificial feed - FCR	3	Chalk & Talk	PPT& Videos
2.5	Induced Breeding – Eyestalk ablation and Hypophysation	2	Chalk & Talk	PPT
UNIT III CULTURE SYSTEMS				
3.1	Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms	2	Lecture	PPT& Videos
3.2	Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber	5	Lecture	PPT& Videos
3.3	Sewage fed fish culture	2	Chalk & Talk	PPT& Videos
3.4	Integrated Fish Farming.	3	Chalk & Talk	PPT& Videos
UNIT IVFISH PATHOLOGY AND POST HARVEST TECHNOLOGY				
4.1	Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases	10	Chalk & Talk	PPT& Videos
4.2	Preservation of Fish	2	Chalk & Talk	PPT& Videos
4.3	Fish Marketing	2	Lecture	PPT& Videos
UNIT V INDIAN FISHERIES				
5.1	Indian Fish Geography	2	Chalk & Talk	PPT& Videos
5.2	Fishing Gears and Methods, Fishing Crafts	5	Chalk & Talk	PPT& Videos
5.3	Indian Exclusive Economic Zone – Use of Remote Sensing and GIS.	2	Chalk & Talk	PPT& Videos
5.4	Role of Government and Public Sector on Indian Fisheries, FFDAs.	4	Chalk & Talk	PPT & Videos

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Session - wise Average	**Better of W1, W2**	**M1+M2**	**MID-SEM TEST**				

	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC	NON - SCHOLASTIC	MARKS

C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non – Scholastic

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	Identify the economically important fishes and fishery products.	K1	PSO1& PSO2
CO 2	Plans according to the recent concepts in fisheries management.	K3	PSO3
CO 3	Distinguish the various aquaculture systems.	K2	PSO5
CO 4	Organizes the type of hatchery, brood stock, larval production, feed management water quality and disease management in cultivable species, live feed production.	K3	PSO4, PSO9
CO 5	Evaluates the Fisheries and Aquaculture Practices in India.	K4	PSO5, PSO7 & PSO10

COURSE DESIGNER: Academic Council 25.09.2020

1. Dr. Antony AmalaJayaseeli

II M.Sc., ZOOLOGY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG3ZE2	Bioinformatics	Elective Core	4 Hrs.	4

COURSE DESCRIPTION

The course provides an outline on various DNA sequencing methods, and principle and methods of sequence analysis with various bioinformatics tools and macromolecular structure prediction.

COURSE OBJECTIVES

To understand the fundamentals of biological sequence analysis and principle of substitution matrices, phylogenetic tree construction and protein structure prediction.

UNITS

UNIT –I DNA SEQUENCING AND BASICS OF INTERNET (12 HRS.)

Sanger's, Chemical, and Automated methods - Hierarchical sequencing and shot gun sequencing - Human Genome Project.Networking in computers: Intranet and internet - TCP/IP, file transfer protocols, web browsers, internet addresses, domain names, basic concepts of HTML, HTTP, web search engines.

Self-study - concepts of HTML, HTTP, web search engines

UNIT –II BIOLOGICAL DATABASES (12 HRS.)

Classification of Biological Databases, Nucleic acid sequence databases: GenBank, EMBL, DDBJ - Protein sequence databases: UNIPROT, Secondary Databases: PROSITE, PRINTS - Genome Databases, Gene Expression database: GEO, Chemical Structure database: PubChem, and Pathway database: KEGG.

Self-study – DDBJ, PRINTS

UNIT –III PAIRWISE ALIGNMENT (12 HRS.)

Pair-wise alignment: Types - Global and local alignment; gapped and ungapped alignment – DOTPLOT, Dynamic programming: Needleman-Wunsch algorithm - Substitution matrices: PAM, BLOSUM - Word methods– Sequence similarity tools: working principle and types of BLAST.

Self-study – DOTPLOT

UNIT –IV MULTIPLE SEQUENCE ALIGNMENT (12 HRS.)

Multiple Sequence alignment: Progressive method and iterative method - applications - ClustalO – Phylogenetic analysis: Orthologs, paralogs, xenologs - Typical structure of phylogenetic tree - types: rooted and unrooted tree, phylogram and cladogram, Phylogenetic algorithm: Phenetic method (UPGMA) – Cladistic method (Maximum parsimony).

Self-study – ClustalO, Cladistic method

UNIT –V STRUCTURE PREDICTION & DRUG DESIGNING (12 HRS.)

Classification of proteins (Review) – Structure databases – Structural classification databases: SCOP, CATH - Secondary structure prediction – Chou-Fasman method, GOR method, Nearest neighbourhood method – Three dimentional structure prediction: homology modeling, threading, *ab initio* – Structure based drug design (SBDD).

Self-study – Structural classification databases

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (12 HRS.)

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10. Attwood T.K and Parrysmith D.J., (2005). *Introduction to Bioinformatics*, Pearson Education.
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12. Gibson G and Muse S.V., (2002). *A Primer of Genomic Science*, Sinauer Associates Inc. Pub., Sunderland.
13. Jones N.C and Pevzner P.A., (2005). *An Introduction to Bioinformatics Algorithms*, Ane Books, New Delhi.
14. Lesk M., (2004). *Introduction to Bioinformatics*, Oxford University Press.
15. Bergeron B.M.D., (2003). *Bioinformatics Computing – The Complete Practical Guide to Bioinformatics for Life Scientists*, Pearson Education (Singapore) Pvt. Ltd., Delhi.
16. Rastogi P.S.C., Namita M and Rastogi P., (2004). *Bioinformatics Concepts, Skills and Applications*, CBS Publishers, New Delhi.

WEB REFERNCES :

1. www.ncbi.nlm.nih.gov
2. www.uniprot.org
3. www.rcsb.org
4. https://prosite.expasy.org
5. www.ncbi.nlm.nih.gov/blast/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 DNA SEQUENCING AND BASICS OF INTERNET				
1.1	Sanger's DNA sequencing	2	Chalk & Talk	Black Board
1.2	Chemical sequencing	1	Chalk & Talk	LCD
1.3	Automated methods	1	Lecture	PPT & White board
1.4	Hierarchical sequencing	2	Lecture	Smart Board
1.5	shot gun sequencing	2	Lecture	Black Board
1.6	Human Genome Project	3	Discussion	Google classroom
1.7	Networking in computers: Intranet and internet - TCP/IP,	1	Lecture	Black Board
1.8	file transfer protocols, web browsers, internet addresses,	1	Discussion	Black Board
1.9	domain names, basic concepts of HTML, HTTP,	1	Lecture	Black Board
2.0	web search engines	1	Lecture	Black Board
UNIT -2 BIOLOGICAL DATABASES				
2.1	Classification of Biological Databases,	1	Lecture	Green Board Charts
2.2	Nucleic acid sequence databases: GenBank,	2	Chalk & Talk	Green Board
2.3	EMBL, DDBJ	1	Chalk & Talk	Black Board
2.4	Protein sequence databases: UNIPROT	2	Chalk & Talk	LCD
2.5	Secondary Databases: PROSITE	1	Lecture	PPT & White board
2.6	PRINTS	1	Lecture	Smart Board
2.7	Genome Databases	2	Lecture	Black

				Board
2.8	Gene Expression database: GEO	2	Discussio n	Google classroom
2.9	Chemical Structure database: PubChem Pathway database: KEGG	1	Lecture	Black Board
UNIT -3 PAIRWISE ALIGNMENT				
3.1	Pair-wise alignment: Types - Global and local alignment	2	Chalk & Talk	Black Board
3.2	gapped and ungapped alignment – DOTPLOT	2	Chalk & Talk	LCD
3.3	Dynamic programming: Needleman-Wunsch algorithm	2	Lecture	PPT & White board
3.4	Substitution matrices: PAM	2	Lecture	Smart Board
3.5	BLOSUM	2	Lecture	Black Board
3.6	Word methods–	2	Discussio n	Google classroom
3.7	Sequence similarity tools: working principle and types of BLAST	3	Lecture	Black Board
UNIT -4 MULTIPLE SEQUENCE ALIGNMENT				
4.1	Multiple Sequence alignment: Progressive method	2	Chalk & Talk	Black Board
4.2	iterative method & applications	2	Chalk & Talk	LCD
4.3	ClustalO	2	Lecture	PPT & White board
4.4	Phylogenetic analysis: Orthologs, paralogs, xenologs	2	Lecture	Smart Board
4.5	Typical structure of phylogenetic tree - types: rooted and unrooted tree, phylogram and cladogram,	2	Lecture	Black Board
4.6	Phylogenetic algorithm: Phenetic method (UPGMA)	3	Discussio n	Google classroom
4.7	Cladistic method (Maximum parsimony)	2	Lecture	Black Board
UNIT -5 STRUCTURE PREDICTION & DRUG DESIGNING				

5.1	Classification of proteins (Review)	1	Chalk & Talk	Black Board
5.2	Structure databases- PDB	2	Chalk & Talk	LCD
5.3	Structural classification databases: SCOP, CATH	2	Lecture	PPT & White board
5.4	Secondary structure prediction – Chou-Fasman method	2	Lecture	Smart Board
5.5	GOR method, Nearest neighbourhood method	2	Lecture	Black Board
5.6	Three dimentional structure prediction: homology modeling, threading, *ab initio*	3	Discussion	Google classroom
5.7	Structure based drug design (SBDD)	3	Lecture	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average 5 Mks.	Better of W1, W2 5+5=10 Mks.	M1+M2 15 Mks	MID-SEM TEST 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Once in Semester / Seminar

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING	PSOs ADDRESSED

		TO REVISED BLOOM'S TAXONOMY)	
CO 1	Recall the features of Human Genome Project	K1	PSO1& PSO2
CO 2	Compare and contrast Hierarchical and shotgun sequencing	K3	PSO2
CO 3	List the different web browsers, search engines and biological databases	K1	PSO1 & PSO11
CO 4	Summarize the information stored in the flatfile of biological databases	K2	PSO11
CO 5	Prepare the DOTPLOT and identify matching sequence and repeat regions	K3	PSO5
CO 6	Compute dynamic programming using Needleman-Wunsch Algorithm	K3	PSO11
CO 7	Explain the development and significance of substitution matrices	K2	PSO1
CO 8	Relate the usage of different PAM and BLOSUM for closely and distantly related sequences	K4	PSO2
CO 9	Recall the methods and applications of multiple sequence alignment	K1	PSO1
CO 10	Model phylogenetic tree based on the distance matrix	K4	PSO11
CO 11	Discuss the secondary structure prediction methods	K2	PSO1 & PSO2
CO 12	Summarize the three dimensional structure prediction methods	K2	PSO1 & PSO2

COURSE DESIGNER:

Dr. J. Asnet Mary

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**	**PG Lab**	**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

1. https://vlab.amrita.edu/index.php?sub=3&brch=258

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 molar extinction coefficient.	4	Chalk & Talk	Colorimeter
7	Estimation of percent purities of dyes and	4	Hands on training	colorimeter

	inorganic compound			
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**
	Session - wise Average	**Better of W1, W2**	**M1+M2**	**MID-SEM TEST**				

	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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
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& PSO11
CO 5	Determine the correlation, regression and significance for the statistical data	K5	PSO3 & PSO5, PSO11

COURSE DESIGNER:

Dr. N. Nagarani

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.
6. Philopose, P.M., (2006). *Experimental Biotechnology*, 1st Edition, Dominant Publishers and Distributors, New Delhi.

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
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				

	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC	NON - SCHOLASTIC	MARKS

C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	Identify and sketch the different lymphoid organs	K1	PSO1& PSO2
CO 2	Recall the properties of soluble and particulate antigen	K1	PSO3
CO 3	Estimate the lymphocytes from peripheral blood	K2	PSO3
CO 4	Demonstrate the various bleeding techniques	K2	PSO3
CO 5	Demonstrate the separation of serum and plasma	K3	PSO3
CO 6	Identify immunoelectrophoresis and rocket immunoelectrophoresis	K1	PSO2 & PSO3
CO 7	Estimate the concentration of test antigen by single/double immunodiffusion	K3	PSO3
CO 8	Experiment the complement mediated lysis	K4	PSO3
CO 9	Infer the formation of precipitin line and button formation	K2	PSO3

COURSE DESIGNER:

Dr. J. Asnet Mary

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4Z16	ENVIRONMENTAL BIOLOGY	PG Core	6	6

COURSE DESCRIPTION

To understand the basic concepts of Ecology.

COURSE OBJECTIVES

To understand the key aspects of ecology, impact of pollution and biodiversity conservation for sustainable development.

UNIT –I ECOSYSTEM AND HABITAT (18 HRS.)

Structure – Components of ecosystems - Food chain, Food web - Ecological pyramids-Trophic levels–energy flow - productivity – Biomagnification- Classification of ecosystems- Introduction, structure and function of terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine) - Energy flow and mineral cycling (CNP)- Concept of habitat and niche ecosystem - Ecological indicators- Biomes - Tundra, Forest, Desert and mountain biomes – Biogeography: biogeographical zones of India.

Self-Study - Structure – Components of ecosystems - Food chain, Food web - Ecological pyramids

UNIT –IIPOPULATION AND COMMUNITY ECOLOGY (18 HRS.)

Concept of population - Biotic potential and Natality, Mortality, Survivorship curves, life table, Age structure, carrying capacity, Environmental resistance -Population growth forms - Life history strategies (r and K selection) –Population fluctuatuions- Population interactions- Competition, Predation, Parasitism, Mutualism -Concept of Community - Structure, Composition and Stratification- Community Function- Ecological succession – Primary and Secondary succession- Climax community - Hydrarch ,Xerarch - Ecotone and Edge effect – Ecological equivalents - Ecotypes and Ecophenes

Self-Study - Population interactions- Competition, Predation, Parasitism, Mutualism

UNIT –III NATURAL RESOURCES (18 HRS.)

Renewable & Non–renewable resources: Renewable resources–Forest Resources: Types of forests-Biomass, Biogas, Solar energy, Wind Energy, Tidal Energy, Geothermal Energy - Non Renewable resources–Fossil fuel (Coal, Petrol & Natural Gas) Nuclear Fuels

Self study - Forest Resources : Types of forests

UNIT –IV ENVIRONMENTAL POLLUTION (18 HRS.)

Impact of pollutants on general fauna, flora and ecosystems - Environmental pollution: Causes, effects and control measures of air, water, soil, noise and nuclear pollution- Greenhouse gases, Ozone layer and depletion –Waste water management – Primary secondary Global Climatic change - *El nino*and *La nina*Phenomenon- Green peace movement- Chipko movement- Nuclear disarmament - Role of Government agencies - Central and state Pollution Control Boards- - Environmental protection act, 1986 - Paris Summit- Kyoto protocol.

Self-Study - Environmental pollution: Causes, effects and control measures of air, water, soil, noise and nuclear pollution

UNIT –V BIODIVERSITY CONSERVATION (18 HRS.)

Concepts of Biodiversity - Need for conservation-Conservation Stratagies- *In situ* conservation - Protected areas, National parks, Sanctuaries,

Biosphere reserves, Sacred groves – *Ex situ* Conservation - Seed Banks, Gene banks- Sthalvirukshas - Animal Translocation- Human animal conflicts and management - Biodiversity database - Endangered animals, endemism and Red data Book- Environmental protection act (1986)- Forest conservation Act (1980)- Biodiversity Act, 2002- Remote sensing and GIS: Methods and Applications in environmental management

Self-study - Concepts of Biodiversity- Need for conservation

REFERENCES:

1. Odum, E.P. and Barrett, G.W. (2005) *Fundamental of Ecology. 5th* Ed., Cengage Learning India. New Delhi.
2. Primark R.B., (2000) *A Primer of Conservation Biology. 2nd Ed.*, SinauerAssociates..
3. Kormondy, E.J. (1996) *Concepts of Ecology. 4th Ed.*, PHI Cengage Learning India, New Delhi).
4. Peter J.R., Stephan, L.W., PauleH., Ceche S. & Bevlerly, M. (2008) *Ecology*. Cengage learning India,New Delhi.
5. Wright, R.T.(2008) *Environmental Science*, 10th Ed., Pearson Education, New Delhi.
6. Smith T.M. & Smith R.L. (2008) *Elements of Ecology*. 6th Ed., Pearson Education, New Delhi.
7. Turk A. & Turk J. (1993) *Environmental Science*. 4th Ed., Saunders.
8. Odum, E.P. & Barrett, G.W. (2005) *Fundamentals of Ecology*. 5th Ed., Cengage Learning India. New Delhi).

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 ECOSYSTEM AND HABITAT ECOLOGY				
1.1	Structure – Components of ecosystems - Food chain, Food web - Ecological pyramids	2	Chalk & Talk	Black Board
1.2	Trophic levels–energy flow - productivity – Biomagnification	2	Chalk & Talk	LCD

1.3	Classification of ecosystems- Introduction, structure and function of terrestrial (forest, grassland)	3	Lecture	PPT & White board
1.4	aquatic (fresh water, marine, estuarine)	3	Lecture	PPT
1.5	Energy flow and mineral cycling (CNP)	3	Lecture	Black Board
1.6	Concept of habitat and niche ecosystem - Ecological indicators-	2	Lecture	Google classroom
1.7	Biomes - Tundra, Forest, Desert and mountain	2	Lecture	PPT
1.8	Biogeography: biogeographical zones of India.	1	Discussio n	Black Board
UNIT -2 POPULATION AND COMMUNITY ECOLOGY				
2.1	Concept of population- Biotic potential and Natality, Mortality, Survivorship curves, life table, Age structure, carrying capacity,	3	Lecture	Green Board Charts
2.2	Environmental resistance - Population growth forms - Life history strategies (r and K selection) –Population fluctuatuions-	3	Chalk & Talk	Green Board
2.3	Population interactions- Competition, Predation,Parasitism,Mutualism -	3	Chalk & Talk	Black Board
2.4	Concept of Community - Structure, Composition and Stratification- Community Function-	3	Chalk & Talk	LCD
2.5	Ecological succession – Primary and Secondary succession-	2	Lecture	PPT & White board
2.6	Climax community - Hydrarch,Xerarch	2	Lecture	PPT
2.7	Ecotone and Edge effect	1	Lecture	Black Board
2.8	Ecological equivalents - Ecotypes and Ecophenes	1	Lecture	Google classroom
UNIT -3 NATURAL RESOURCES				

3.1	Renewable & Non–renewable resources: Renewable resources	1	Chalk & Talk	Black Board
3.2	Forest Resources: Types of forests	3	Chalk & Talk	LCD
3.3	Biomass, Biogas	4	Lecture	PPT & White board
3.4	Solar energy, Wind Energy	4	Lecture	PPT
3.5	Tidal Energy, Geothermal Energy	2	Lecture	Black Board
3.6	Non Renewable resources–Fossil fuel (Coal, Petrol & Natural Gas) Nuclear Fuels	4	Lecture	Google classroom
UNIT -4 ENVIRONMENTAL POLLUTION				
4.1	Impact of pollutants on general fauna, flora and ecosystems - Environmental pollution: Causes, effects and control measures of air, water, soil,	3	Discussio n	Google classroom
4.2	noise and nuclear pollution	2	Discussio n	Google classroom
4.3	Waste water management – Primary secondary	2	Chalk & Talk	Black Board
4.4	Greenhouse gases, Ozone layer and depletion	2	Chalk & Talk	LCD
4.5	Global Climatic change - *El nino*and *La nina*Phenomenon-	3	Lecture	PPT & White board
4.6	Green peace movement- Chipko movement- Nuclear disarmament	2	Lecture	PPT
4.7	Role of Government agencies - Central and state Pollution Control Boards	2	Lecture	Black Board
4.8	Environmental protection act, 1986 - Paris Summit- Kyoto protocol.	2	Lecture	Google classroom
UNIT -5 BIODIVERSITY CONSERVATION				
5.1	Concepts of Biodiversity - Need for conservation	2	Discussio n	Google classroom
5.2	Conservation Stratagies- *In situ* conservation - Protected areas, National parks, Sanctuaries, Biosphere reserves, Sacred	4	Chalk & Talk	Black Board

	groves			
5.3	*Ex situ* Conservation - Seed Banks, Gene banks- Sthalvirukshas	3	Discussio n	Google classroom
5.4	Animal Translocation- Human animal conflicts and management	2	Chalk & Talk	Black Board
5.5	Biodiversity database - Endangered animals, endemism and Red data Book	3	Chalk & Talk	LCD
5.6	Environmental protection act (1986)- Forest conservation Act (1980)- Biodiversity Act, 2002	2	Lecture	Black Board
5.7	Remote sensing and GIS: Methods and Applications in environmental management	2	Lecture	Google classroom

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED	PSOs ADDRESSED

		BLOOM'S TAXONOMY)	
CO 1	Develop an understanding of ecological key interactions and processes	**K6**	PSO1& PSO3
CO 2	Elaborate how minerals enter, used and exit an ecosystem	**K6**	PSO1& PSO2
CO 3	Explain the factors that affect population size, Density,Distribution and dynamics	**K5**	PSO1& PSO 3
CO 4	Compare Ecological niche and habitat	**K2**	PSO2&PSO1
CO 5	Agree significance of Biodiversity, consequences on loss of Biodiversity andconservation Strategies	**K5**	PSO7& PSO8
CO6	Design novel mechanism for the sustainable utilization of natural resources	**K6**	PSO6& PSO3
CO7	Criticize various kinds of pollution in the environment, their impact on the ecosystem	**K5**	PSO6 &PSO8
CO8	Analyze causes of climatic change and its effects	**K4**	PSO3 &PSO7

COURSE DESIGNER:

Dr. V. Bharathy

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19 PG4Z17	Biotechnology	Major Core	6	5

COURSE DESCRIPTION

This course provides knowledge about genetic engineering and rDNA technology and its application in gene therapy, cell culture and GM food.

COURSE OBJECTIVES

- To familiarize the use of tools and techniques of genetic engineering for the study of living organisms, or derivatives to make or modify products for specific use for human welfare.
- Understand DNA finger printing and its application,
- Know about the application of animal cell culture for *in vitro* testing of drugs.

UNITS

UNIT –I RECOMBINANT DNA TECHNOLOGY (18HRS.)

Scope and importance of rDNA technology – Tools of rDNA technology: Enzymes involved in rDNA technology - Linkers and Adaptors – Cloning vectors: bacterial plasmid vectors – pBR322, pUC vectors – Agrobacterium based plasmids –cosmids – shuttle vectors - λ and M13 phage vectors – YAC - Simian virus 40, BAC and Transposons.

Self-study – Scope and importance of rDNA technology – Tools of rDNA technology: Enzymes involved in rDNA technology

UNIT –II TECHNIQUES OF GENETIC ENGINEERING (18 HRS.)

Gene transfer techniques: Transformation, Transduction, Biolistic, Microinjection, Liposome fusion, Electroporation, and agroinfection - Selection of recombinants: Reporter genes, Blue-white selection method - preparation of cDNA- Hybridization techniques - DNA finger printing: RFLP & PCR techniques - Genomic library - Blotting techniques: Southern, Northern and Western blotting.

UNIT –III ANIMAL BIOTECHNOLOGY (18 HRS.)

Basics of animal cell, tissue and organ culture - Primary culture and established cell line culture - Basic techniques of mammalian cell culture and application -Organ culture ,whole embryo culture Embryo transfer and splitting - *In vitro* fertilization (IVF) technology - Nuclear transplantation: Dolly - Manipulation of reproduction in animals-Transgenic animals-strategies for gene transfer, Targeted gene transfer, Artificial insemination, Animal Bioreactor and Molecular Farming, Human gene therapy, Cryobiology.

UNIT –IV PLANT BIOTECHNOLOGY (18 HRS.)

Introduction to the techniques of plant tissue culture - Historical background – Basic requirements for a tissue culture lab - Totipotency - Requirements for cell and tissue culture - Nutrient media - culture of plant materials - single cell culture, Organogenesis: Root and Shoot culture, Micropropagation- Somaclonal variation - Somatic embryogenesis and production of embryoids: Haploid and double haploid production - Protoplast isolation and culture, Somatic hybridization and Cybrid production and their applications in crop improvement - GM foods.

Self-study – GM foods

UNIT –V REGENERATIVE MEDICINE (18 HRS.)

Stem cells: Types, isolation umbilical cord blood cells, mesenchymal cells –- Current status and application in medicine, Application of animal cell culture for *in vitro* testing of drugs; Production of recombinant hemoglobin, blood substituents, Artificial blood, General account of *in vitro* regulation of blood cells production - Bioethics of stem cell research.

Self-study – Stem cells: Types, isolation umbilical cord blood cells

DIGITAL OPEN EDUCATIONAL RESOURCES

https://facultystaff.richmond.edu/~lrunyenj/bio554/lectnotes/chapter 14.pdf

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4. Dubey R.C., (2004*) A Text book of Biotechnology*, 3rd ed., S. Chand and company Ltd., New Delhi.
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6. Old R.W. and Primrose, S.B.,(1985) *Principles of Gene Manipulations*, An introduction to Genetic Engineering, Oxford Blackwell Publishers, London.
7. Winnacker E.L., (2003) *From Genes to Clones,* Panima Publishing Corporation, New Delhi.
8. Sree Krishna V., (2007) *Bioethics and Biosafety in Biotechnology*, 1st ed., New Age International Publishers, New Delhi.
9. Helen K and Adrianne M., (2001) *Recombinant DNA and Biotechnology: A Guide for students,* 2nd ed., American Society for Microbiology Press, Washington D.C, USA.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**RECOMBINANT DNA TECHNOLOGY**			
1.1	Linkers and Adaptors	2	Chalk & Talk	Black Board
1.2	Cloning vectors: bacterial plasmid vectors	3	Chalk & Talk	LCD
1.3	pBR322, pUC vectors	3	Lecture	PPT
1.4	Agrobacterium based plasmids - cosmids	3	Lecture	Black Board
1.5	shuttle vectorsλ and M13 phage vectors –	3	Lecture	Black Board
1.6	YAC - Simian virus 40, BAC	2	Chalk & Talk	Black Board
1.7	Transposons	2	Chalk & Talk	Black Board
1.8	Self-study – Scope and importance of rDNA technology – Tools of rDNA technology: Enzymes involved in rDNA technology		Discussion	
UNIT -2	**TECHNIQUES OF GENETIC ENGINEERING**			
2.1	Gene transfer techniques: Transformation	3	Chalk & Talk	Black Board
2.2	Biolistic, Microinjection, Liposome fusion, Electroporation, and agroinfection	3	Chalk & Talk	LCD
2.3	Transduction, - Selection of recombinants: Reporter genes,	2	Lecture	PPT
2.4	Blue-white selection method	1	Chalk & Talk	LCD
2.5	preparation of cDNA	1	Lecture	Black Board
2.6	Hybridization techniques - DNA finger printing: RFLP & PCR techniques	3	Chalk & Talk	Black Board
2.7	Genomic library - Blotting techniques: Southern, Northern and Western blotting.	3	Chalk & Talk	Black Board
UNIT -3	**ANIMAL BIOTECHNOLOGY**			

3.1	Basics of animal cell, tissue and organ culture - Primary culture and established cell line culture	2	Chalk & Talk	Black Board
3.2	Basic techniques of mammalian cell culture and application	2	Chalk & Talk	LCD
3.3	Organ culture ,whole embryo culture Embryo transfer and splitting	3	Lecture	PPT
3.4	*In vitro* fertilization (IVF) technology - Nuclear transplantation: Dolly	3	Lecture	Black Board
3.5	Manipulation of reproduction in animals-Transgenic animals	3	Chalk & Talk	PPT
3.6	strategies for gene transfer, Targeted gene transfer, Artificial insemination	3	Chalk &Talk	LCD
3.7	Animal Bioreactor and Molecular Farming, Human gene therapy, Cryobiology	2	Lecture	PPT
UNIT -4PLANT BIOTECHNOLOGY				
4.1	Introduction to the techniques of plant tissue culture	2	Chalk & Talk	Black Board
4.2	Historical background – Basic requirements for a tissue culture lab - Totipotency	2	Chalk & Talk	LCD
4.3	Requirements for cell and tissue culture - Nutrient media	3	Lecture	PPT
4.4	culture of plant materials - single cell culture,	2	Lecture	Black Board
4.5	Organogenesis: Root and Shoot culture, Micropropagation- Somaclonal variation - Somatic embryogenesis and production of embryoids	3	Chalk & Talk	Black Board
4.6	Haploid and double haploid production - Protoplast isolation and culture	3	Chalk & Talk	LCD
4.7	Somatic hybridization and Cybrid production and their applications in crop improvement	3	Lecture	PPT

4.8	Self-study – GM foods		Discussion	
UNIT -5REGENERATIVE MEDICINE				
5.1	Current status and application in medicine	3	Chalk & Talk	Black Board
5.2	Application of animal cell culture for *in vitro* testing of drugs;	4	Chalk & Talk	LCD
5.3	Production of recombinant hemoglobin,	4	Lecture	PPT
5.4	blood substituents, Artificial blood, General account of *in vitro* regulation of blood cells production	4	Lecture	PPT
5.5	Bioethics of stem cell research	3	Chalk & Talk	Black Board
5.6	Self-study – Stem cells: Types, isolation umbilical cord blood cells		Discussion	

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING	PSOs ADDRESSED

		TO REVISED BLOOM'S TAXONOMY)	
CO 1	Find the enzymes in rDNA technology	K1	PSO1
CO 2	Compare the cloning vehicles with their specific advantages.	K2	PSO1
CO 3	Criticize the boon technology of *in-vitro* fertilization	K5	PSO1
CO 4	Analyse the technique of tissue culture	K4	PSO2
CO 5	Identify the importance of artificial blood	K1	PSO1

COURSE DESIGNER:

1. **Dr. V. Bharathy**
2. **Dr. S. Barathy**

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19PG4Z18	Developmental Biology	MAJOR CORE	6 Hrs.	5

COURSE DESCRIPTION

This Course focuses on the developmental process from a single egg to zygote by fertilization, into blastula by Cleavage, followed by Gastrulation into Gastrula. From Gastrula, organ forming rudiments are formed, which give rise to the Organ Systems of the Organism.

COURSE OBJECTIVES

Imparts knowledge on the developmental process from a single egg to foetus, then in an adult.

UNITS

UNIT I: INTRODUCTION TO DEVELOPMENTAL BIOLOGY (15 HRS)

Historical Review and Scope of Embryology; Reproductive Cycles – Regulation; Structure of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes; Gametogenesis : Migration of Germ cells in Vertebrates, Spermatogenesis and Oogenesis

UNIT II: FERTILIZATION (15 HRS)

Fertilization – Sea Urchin, and Mammals - Approach of the Spermatozoan to the Egg; Reaction of the Egg; Fusion of Gametic Nuclei; Egg Cytoplasm rearrangement by Fertilization; Parthenogenesis.

UNIT III: CLEAVAGE (15 HRS)

Cleavage: Planes of Cell Divisions; Patterns of cleavage; Laws of Cleavage; Cellular Mechanism of Cleavage; Morula and Blastula; Physiology of Cleavage; Products of Cleavage;; Role of Maternal genes during the early Development.

UNIT IV: GASTRULATION (15 HRS)

Gastrulation – Unique features – Gastrula; Morphogenetic movements; Fate maps, Fate of Germinal layers; Axis Formation in Sea Urchin, Fishes,

Amphibians, Birds and Mammals; Concept of Spemann's Organizer; Formation of Extra embryonic membranes; Placentation in Mammals

UNIT V: ORGANOGENESIS & POSTEMBRYONIC DEVELOPMENT

(15 HRS)

Development of Central Nervous System, Heart and Lungs; Metamorphosis in Insects, and Amphibians; Teratology; Types of Regeneration, Molecular basis and rôle of Genes on Teratology; Aging and Senescence.

REFERENCE BOOKS:

1. Browder L.N., *Developmental Biology*, Saunders College, Philadelphia (1980).
2. Balinsky B.L., *An Introduction to Embryology*, 5th ed., Saunders Co., Philadelphia (1981).
3. Berrill N.J., *Developmental Biology*, Tata McGraw Hill, New Delhi, (1986).
4. Carlson B.M., *Foundations of Embryology*, Tata McGraw Hill, New Delhi, (2007).
5. Gilbert S.F., *Developmental Biology*, Sinamer Associates Inc. Saunderland, Massachusets, U.S.A. (2003).

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO DEVELOPMENTAL BIOLOGY				
1.1	Historical Review and Scope of Embryology	2	Chalk & Talk	LCD
1.2	Reproductive Cycles –Regulation	4	Chalk & Talk	LCD
1.3	Structure of sperms and eggs - influence of yolk - polarity - symmetry - Egg membranes;	3	Lecture	PPT
1.4	Gametogenesis : Migration of Germcells in Vertebrates,	4	Lecture	PPT

	Spermatogenesis and Oogenesis			
UNIT II: FERTILIZATION				
2.1	Fertilization – Sea Urchin, and Mammals - Approach of the Spermatozoan to the Egg; Reaction of the Egg; Fusion of Gametic Nuclei;	5	Discussion	Google classroom
2.2	Egg Cytoplasm rearrangementby Fertilization;	3	Specimen	Microscope
2.1	Parthenogenesis.	2	Discussion	Black Board
UNIT III: CLEAVAGE				
2.1	Cleavage: Planes of Cell Divisions; Patterns of cleavage; Laws of Cleavage	5	Lecture	Green Board Charts
2.2	Cellular Mechanism of Cleavage; Morula and Blastula	2	Chalk & Talk	Green Board
1.1	Physiology of Cleavage	2	Chalk & Talk	Black Board
1.2	Products of Cleavage	2	Chalk & Talk	LCD
1.3	Role of Maternal genes during the early Development	2	Lecture	PPT
UNIT IV: GASTRULATION				
4.1	Gastrulation – Unique features– Gastrula	2	Lecture	Black Board
4.2	Morphogenetic movements; Fate maps	2	Discussion	Google classroom
4.3	Fate of Germinal layers; Axis Formation in Sea Urchin, Fishes, Amphibians, Birds and Mammals	4	Specimen	Microscope
4.4	Concept of Spemann's Organizer	2	Discussion	Black

				Board
4.5	Formation of Extra embryonic membranes; Placentation in Mammals	3	Lecture	LCD
UNIT V: ORGANOGENESIS & POST EMBRYONIC DEVELOPMENT				
5.1	Development of Central Nervous System, Heart and Lungs	5	Lecture	LCD
5.2	Metamorphosis in Insects, and Amphibians	3	Lecture	LCD
5.3	Teratology; Molecular basis, Role of Genes on Teratology & Types	3	Lecture	LCD
5.4	Aging and Senescence	2	Lecture	LCD

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S	PSOs ADDRESSED

		TAXONOMY)	
CO 1	Recalls the basic concepts of Developmental Biology.	K1	PSO1& PSO2
CO 2	Explain how fertilization, cleavage and Gastrulation occur.	K2	PSO2
CO 3	Compares the basic concepts of organogenesis in different organisms.	K2	PSO5
CO 4	Understand the development of egg into a foetus, then into adult.	K2	PSO2, PSO11
CO 5	Associate the embryo development with Phylogeny.	K3	PSO2, PSO9

COURSE DESIGNER:

1. **Dr. Antony Amala Jayaseeli**

II M.Sc.,Zoology

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19 PG4ZE3	ECONOMIC ZOOLOGY	PG Major Elective	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: *Apisdorsata*,*Apisindica*, *Apisflorea*, *Apismellifera*– 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.
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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.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6359672/**
2. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4632584/**
3. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2748269/**

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: *Apisdorsata*,	3	Chalk & Talk	LCD
1.3	*Apisindica*, *Apisflorea*, *Apismellifera*	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 -3PRAWN 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 -4POULTRY 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 -5DAIRY FARMING				
5.1	Indigenous and exotic breeds	3	Lecture	LCD
5.2	Rearing – housing	3	Chalk & Talk	Black Board
5.3	feedandrationing	2	Chalk &Talk	Black Board
5.4	Commercial importance of dairyfarming	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
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2-**Understand, **K3-**Apply, **K4-**Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	**K2**	PSO2

	adaptation in bees in relation to their social behaviour.		
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	Discuss the rearing methods of chick.	**K6**	PSO2
CO 5	Find the feed formulations for chick.	**K1**	PSO10
CO 6	Assess the commercial importance of dairy farm	**K5**	PSO10

COURSE DESIGNER:

1. **Dr. S. Barathy**

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**	**PG Major Elective**	**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
5. Saunders D.S., Steel C.G.H. (2002). *Insect Clocks* Afopoulou (ed.)R.D. Lewis. (3rdEd) Barens and Noble Inc. New York, USA
6. Manning A. and Dawkins M.S, (2012). *An Introduction to Animal Behaviour*, Cambridge, University Press, UK.
7. John A. (2001). *Animal Behaviour*, Sinauer Associate Inc., USA. 7th Ed.
8. Paul W. S and John A. (2013). *Exploring Animal Behaviour*, Sinauer Associate Inc., Massachusetts, USA. 6th Ed.

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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	Discussio n	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,		Chalk & Talk	Black Board

	courtship			
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 mate choice for female fitness, monogamous verses polygamous sexual conflict.		Lecture	PPT & White board
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 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	Chalk & Talk	PPT
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	Discussio n	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
	Session - wise Average 5 Mks.	Better of W1, W2 5+5=10 Mks.	M1+M2 15 Mks	MID-SEM TEST 5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

  K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse
- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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
CO 2	Explains the role of visual, auditory communication with respect to learning and instincts mechanism	**K5**	PSO2
CO 3	Discuss the various reproductive and social behaviours in context to pair selection.	**K6**	PSO2
CO 4	Summarizes the ecological condition such as hunger, thirst, territories etc., in influencing the animal behaviour.	**K2**	PSO2 & PSO4
CO 5	Compare the circadium and cirannual behaviour	**K4**	PSO2
CO 6	Elaborate the molecular regulation of circadian rhythm	**K6**	PSO1&PSO2

COURSE DESIGNER:

1. **Dr. N.Nagarani**

II M.Sc., ZOOLOGY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**19 PG4Z19**	**Lab In Environmental Biology & Developmental Biology**	**PG Lab**	**4**	**2**

COURSE DESCRIPTION

This course provides knowledge about the relationship between organisms and their environment. It also helps to learn about development of organisms.

COURSE OBJECTIVES

- Enable the students to estimate the physico-chemical parameters of soil and water.
- Observe the different developmental stages of chick embryo and record it.
- Understand the life cycle of *Drosophila melanogaster* by rearing them and record the observation.

UNITS

Ecology

1. Study of Pond/ River ecosystem - Food web and food chain
2. Determination of chlorides in soil
3. Estimation of Primary Productivity
4. Estimation of pH of soil
5. Estimation of soil organic carbon
6. Estimation of alkalinity of soil
7. Estimation of alkalinity of water
8. Quantitative estimation of salinity, phosphates and nitrates in water samples
9. Estimation of Biological Oxygen Demand (BOD).
10. Identification of Planktonic organisms.
11. Observation of species using quadrat method

Field Study Report

- Visit to Pollution Control Board

Developmental Biology

1. Identification of chick embryo developmental stages – 24hrs, 48hrs, 72hrs, &96hrs.
2. Study of life cycle of *Drosophila melanogaster*.
3. Contraceptive devices.
4. Placenta of goat.

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

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5131676/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2562489/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4454838/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
ECOLOGY				
1	Study of Pond/ River ecosystem - Food web and food chain	4	Demonstration	
2	Determination of chlorides in soil	4	Demonstration & hands on training	Soil
3	Estimation of Primary Productivity	4	Demonstration & hands on training	Pond water
4	Estimation of pH of soil	4	Demonstration & hands on training	Soil
5	Estimation of soil organic carbon	4	Demonstration & hands on training	Soil
6	Estimation of alkalinity of soil	4	Demonstration & hands on training	Soil
7	Estimation of alkalinity of water	4	Demonstration & hands on training	Water
8	Quantitative estimation of salinity, phosphates and nitrates in water samples	4	Demonstration & hands on training	Water
9	Estimation of Biological Oxygen Demand (BOD).	4	Demonstration & hands on training	Water
10	Identification of Planktonic organisms.	4	Demonstration & hands on training	Pond water
11	Observation of species using quadrat method	4	Demonstration & hands on training	

	Field Study Report Visit to Pollution Control Board			
DEVELOPMENTAL BIOLOGY				
1	Identification of chick embryo developmental stages – 24hrs, 48hrs, 72hrs, &96hrs.	4	Demonstration	Hen's egg
2	Study of life cycle of *Drosophila melanogaster*.	4	Hands on training	Ripened fruits
3	Contraceptive devices.	4	Explanation	
4	Placenta of goat.	4	Demonstration	Specimen

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**-**		**-**	**-**
K2	**-**	**5**	**4**	**2 ½**	**5**		**5**	**12.5 %**
K3	**-**	**-**	**3**	**5**	**12**		**12**	**30 %**
K4	**-**	**-**	**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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL	PSOs ADDRESSED

		(ACCORDING TO REVISED BLOOM'S TAXONOMY)	
CO 1	Find the primary productivity	K1	PSO3
CO 2	Demonstrate the estimation of various components of soil and water.	K2	PSO3
CO 3	Identify the zoo planktons in water sample.	K3	PSO4
CO 4	Analyse the various developmental stages of chick embryo.	K4	PSO3
CO 5	Compare the diversity of species by quadrat method.	K5	PSO2

COURSE DESIGNER:

1. **Dr. S. Barathy**

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**	**PG Lab**	**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

1. **https://www.youtube.com/watch?v=nr1tV_LuqJk**
2. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3395714/**

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	4	Demonstration & hands on training	Plant

	formation.			
3	Micropropagation techniques	4	Demonstration & hands on training	
4	Isolation of genomic DNA fromgoatliver	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
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

✔ **The I PG course teachers are requested to start conducting S1, W1, M1,**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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

COURSE DESIGNER:

1. **Dr. S. Barathy**

II M.Sc., ZOOLOGY

SEMESTER – III & IV

SELF-LEARNING PAPER

(For those who joined in 2019 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	19 PGSLZ1	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 OBJECTIVE/S

- 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.

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.

WEB REFERENCES

1. https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5 Mks	5+5=10 Mks.	15 Mks	35 Mks.	5 Mks.	40Mks.	
K1	**5**	**-**	**-**	**2 ½**	**7.5**	-	**7.5**	18.75 %
K2	**-**	**5**	**4**	**2 ½**	**11.5**	-	**11.5**	28.75 %
K3	**-**	**-**	**3**	**5**	**8**	-	**8**	20 %
K4	**-**	**-**	**3**	**5**	**8**	-	**8**	20 %
Non Scholastic	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**5**	**5**	**10**	**15**	**35**	**5**	**40**	**100 %**

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

- ✔ **All the course outcomes are to be assessed in the various CIA components.**
- ✔ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I UG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

- ✔ **The I UG course teachers are requested to start conducting S1, W1, M1, in due intervals of time.**

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

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	K3	PSO6, PSO7

	that increase the prevalence of vector borne diseases		
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

COURSE DESIGNER:

1. **Dr. J. Asnet Mary**

Head of the Department

Dr. A. TAMIL SELVI
Head, Dept. of Zoology
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