



ALAGAPPA UNIVERSITY

(A State University Established in 1985)
Karaikudi - 630003, Tamil Nadu, India



2017	2018	2018	2019	2019
 Accredited with A+ Grade by NAAC (CGPA : 3.84)	 MHRD Govt. of India  UGC University Grants Commission Graded as Category - 1 & Granted Autonomy	 MHRD GOVERNMENT OF INDIA Swachh Campus Rank : 4	 nirf NATIONAL INSTITUTIONAL RANKING FRAMEWORK Rank : 28	 QS India Rank : 28 BRICS Rank : 104 Asia Rank : 216

DEPARTMENT OF ANIMAL HEALTH AND MANAGEMENT



M.Sc., ZOOLOGY

[Choice Based Credit System (CBCS)]

[For the candidates admitted from the academic year 2019 -2020]

The panel of Members-Broad Based Board of Studies

Chairperson

Dr.B.Vaseeharan, Professor and Head, Department of Animal Health and Management, Alagappa University, Karaikudi. Teaching Experience: 13, Research experience: 18, Area of Research: Invertebrate Immunotherapy, Nanopharmacology, and Biomaterials.



Foreign Experts

Prof. Dato' Dr. Alién Tan ShauHwai, Director of Centre for Marine and Coastal Studies, Universiti Sains Malaysia (USM), alieen@usm.my. Working Experience – 30 Year, Research Experience- 27, Area of Research: Expertise is in marine science, specializing in mariculture and conservation of molluscs.



Prof. Siti Azizah Mohd. Nor, Principal Research Fellow, University Malaysia Terengganu, s.aziah@umt.edu.my. Work experience: > 30 Years, Area of Research: Population genetics and phylogeography research, for the conservation of wild and captive populations, mainly of important aquatic organisms.



Indian Experts

Prof. M. Ramesh, Unit of Toxicology, Department of Zoology, Bharathiar University, Coimbatore - 641 046. mathanramesh@yahoo.com. Professional experience: Research – 25 Year, Teaching – 18 Years, Area of Research: Toxicology, Aquatic Toxicology, Fish Physiology and Biochemistry, Limnology, Aquaculture and Fisheries, Pharmacology and Toxicology, Eco biotechnology, Environmental Impact Assessment.



Prof. S. Janarthanam, Professor and Head, Department of Zoology, University of Madras, Guindy Campus, Chennai, janas.09@unom.ac.in. Professional experience: Teaching: 20 Years Research: 25 years, Broad Area of Research: Entomology.



Expert from Industry

Dr. V. Ganeshan, Technical Director, Acme ProGen Biotech (India) Private Limited. He is a doctorate in Molecular Biology from the University of Madras. ProGen supplies instruments/equipment to support life sciences researches and also distributes the highest quality product of biochemicals.



Members

Prof. E. Kannapiran, Professor in Zoology, Alagappa University, Karaikudi, Teaching Experience: 21 years, Research Experience: 20 years, Area of Research: Aquatic Microbiology and Coral reef ecosystem.



Dr. P. Srinivasan, Associate Professor, Department of Animal Health and Management, Alagappa University. Teaching Experience: 12, Area of Research: Aquaculture Biotechnology, Phage therapy for *Vibrio spp* control in Aquaculture, Cancer biology.



Dr. N. M. Prabhu, Assistant Professor, Department of Animal Health and Management, Alagappa University, Karaikudi. Teaching Experience: 11, Research Experience: 11, Industrial Experience: 9 years, Area of Research: Disease Control and Prevention, Alternative medicine: Sulfated polysaccharides, probiotics, and nanoparticles.



Dr. M. Biruntha, Assistant Professor, Department of Animal Health and Management, Alagappa University, Karaikudi. Teaching Experience: 10 Years, Research Experience: 4 years, Area of Research: Vermitechnology.



Dr. V. Nithya, Assistant Professor, Department of Animal Health and Management, Alagappa University, Karaikudi. Teaching Experience: 10 Years, Research Experience: 10 years, Area of Research: Pharmacognosy.



Dr. P. Kumar, Assistant Professor, Department of Animal Health and Management, Alagappa University, Karaikudi. Teaching Experience: 4, Research Experience: 4 years, Area of Research: Molecular Cancer biology.



Dr. Subeena Bagum, Assistant Professor in Zoology, Alagappa University, Karaikudi. Teaching Experience: 17, Research Experience: 9 years, Area of Research: Immunology.



Alumni

Dr. K. Devi, Post-Doctoral Fellow, Department of Physiology, Eastern Virginia School of Medicine, Virginia. Email: kdevinfmc@gmail.com, Teaching Experience: 6 months: Research Experience: 1 Year. Area of Research: Diabetology, Molecular Biology, Molecular Genetics.



REGULATIONS AND SYLLABUS

[For the candidates admitted from the academic year 2019 onwards]

1. Programme general objectives

The general objective of the M.Sc program in zoology is to develop strong-minded graduates with high-quality skills in the field of animal sciences. The curriculum designed to assist the students in understanding the vital concept of animal diversity, the function of living systems, from the cell and molecular biology to genetics, as well as evaluation, fishery biology, ecology, and conservation biology. At the end of the program, the student will gain in-depth knowledge in zoology subjects and play an active role in biological research, government or non-government organization, and private sectors.

2. Programme specific objectives

1. To provide the student with pertinent information in the field of Zoology.
2. To teach the student with a broad understanding of animals and their interactions with the environment.
3. To make clear how organisms function at the level of the gene, cell, tissue, organ, system, and physiology.
4. To provide in-depth knowledge to the students in the field of economic zoology that will give confidence to the student for self-employment.
5. To enable the students for preparing various government and private sectors competitive examinations

3. Programme outcome

On successful completion of the programme

1. The students will be able to engage in noteworthy, self-governing, and creative research in Zoology.
2. The skill-based courses support the student in developing entrepreneurship in the field of Zoology.
3. The student acquired significant knowledge to clear the competitive examinations.

4. Eligibility for admission

A candidate who has passed UG Degree with Zoology/Biological Sciences/Life sciences [**except Botany**] as the main subject of study from any University/colleges shall be permitted to appear and qualify for the M.Sc. Zoology programme.

5. Duration of Programme

The programme shall consist of two academic years, divided into four semesters. Each semester consists of 90 working days.

6. Teaching Methods

The classroom teaching would be through conventional lectures, use of OHP, PowerPoint presentation, novel innovative teaching ideas like television, smartboard, and computer-aided instructions. Periodic field visit enables the student for gathering the practical experience and up to date industrial scenario. Student seminars would be arranged to improve their communicative skills. In the laboratory, safety measures instruction would be given for the safe handling of chemicals and instruments. The lab experiments shall be conducted with special efforts to teach scientific knowledge among students. The students shall be trained to handle advanced instrumental facilities and shall be allowed to do experiments independently. The periodic test will

be conducted for students to assess their knowledge. Slow learners would be identified and will be given special attention by remedial coaching. Major and electives would be held in the Department, and for Non-major electives, students have to undertake other subjects offered by other departments.

7. Examinations

The examinations shall be conducted separately for theory and practical's to assess the knowledge acquired during the study. There shall be two systems of examinations viz., internal and external examinations. The internal examinations shall be conducted as Continuous Internal Assessment tests I and II (CIA Test I & II). The internal assessment shall comprise a maximum of 25 marks for each subject. The following procedure shall be followed for awarding internal marks.

7.1. Internal Assessment

7.1.1 Theory paper (Internal Assessment)

Average marks of two CIA test	10 marks
Attendance	5 marks
Seminar/group discussion/quiz	5 marks
Assignment/field trip report/case study report.	5 marks
Total	25 marks

7.1.2 Practical's (Internal Assessment)

CIA tests	10 marks
Attendance	5 marks
Observation notebook	10 marks
Total	25 marks

7.2. External Examinations

The external examinations of theory and practicals shall be conducted for three hours duration to each paper at the end of each semester. The external examinations shall comprise of a maximum of 75 marks for each subject. The candidate failing in any subject will be permitted to appear for each failed subject in the subsequent examination. Practical examinations and demonstration of experiments shall be conducted at first, second, and third semester. At the end of the fourth semester, the project work viva-voce examination will be held based on the dissertation report submitted by the student. Two examiners (one internal and one external) will jointly conduct the viva-voce examination for evaluation.

7.2.1 Scheme of External examination

Question paper pattern (Theory)

1. The question paper carries a maximum of 75 marks.
2. The question paper consists of three sections, namely Part-A, B, and C.
3. **Part-A** consists of 10 questions of 2 marks each ($10 \times 2 = 20$ marks) with no choice. The candidate should answer all the questions.
4. **Part-B** consists of 5 either-or choice questions. Each question carries 5 marks ($5 \times 5 = 25$ marks).
5. **Part-C** consists of 5 questions. Each question carries 10 marks. The candidate should answer any three questions ($10 \times 3 = 30$ marks).

Question paper pattern (Practical) (Maximum 75 marks)

1. Major Practical	15 Marks
2. Minor Practical	10 Marks
3. Experimental setup	5 Marks
4. Spotters	25 Marks
5. Viva-voce	10 Marks
6. Practical Record Note	10 Marks

Total **75 Marks**

8. Passing minimum

- a) For Internal and External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.
- b) In the aggregate (External + Internal), the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.
- c) Grading shall be based on overall marks obtained (internal + external).

9. Dissertation Work (Maximum Marks: 100)

The duration of the Dissertation Work shall be a minimum of three months in the fourth semester.

a) Plan of work

The candidate shall undergo Dissertation Work during the fourth semester. The candidate should prepare a scheme of work for the dissertation and should get approval from the guide. The candidate, after completing the dissertation work, shall be allowed to submit to the university at the end of the fourth semester. If the candidate is desirous of availing the facility from other universities/laboratory, they will be permitted only after getting approval from the guide. In such a case, the candidate shall acknowledge the same in their dissertation.

b) No. of copies of the dissertation

The candidate should prepare three copies of the dissertation and submit the same for the evaluation of examiners. After evaluation, one copy will be retained in the department library, one copy will be retained by the guide and the student shall hold one copy.

c) Format to be followed for dissertation

The format /certificate for thesis to be followed by the student are given below

- Title page
- Certificate
- Acknowledgment

Content as follows:

Chapter No	Title	Page No
1	Introduction	
2	Review of Literature	
3	Materials and Methods	
4	Results	
5	Discussion	
6	Summary	
7	References	

d) Format of the title page

Title of Dissertation

Dissertation submitted in partial fulfillment of the requirement for the degree of Master of Science in Zoology to the Alagappa University, Karaikudi -630003.

By

(Student Name)

(Register Number)

University Logo

Department of Animal Health and Management

Alagappa University

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank-216, QS BRICS Rank-104,

QS India Rank-20)

Karaikudi - 630003

(Year)

Format of certificate

Certificate

This is to certify that the dissertation entitled _____ submitted in partial fulfilment for the requirement of the Degree of Master of Science in Zoology to the Alagappa University, Karaikudi is a bonafide record of research work done by Mr./Mrs _____ under my supervision and guidance and that no part of the dissertation has been submitted for the award of degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or in full in any scientific journal or magazines.

e) Dissertation evaluation

Dissertation Work	:	50 Marks
Internal Assessment	:	25 Marks
Viva -voce	:	25 Marks
Total	:	100 Marks

10. Village Extension Programme (VEP)

The Sivaganga and Ramnad districts are very backward districts where a majority of people lives in poverty. The rural mass is economically and educationally backward. Thus the aim of the introduction of this Village Extension Programme is to extend out to reach environmental awareness, social activities, hygiene, and health to the rural people of this region. The students in their third semester have to visit any one of the adopted villages within the jurisdiction of

Alagappa University and can arrange various programs to educate the rural mass in the following areas for three day based on the following theme.

1. Environmental awareness
2. Hygiene and Health

A minimum of two faculty members can accompany the students and guide them.

11. Maximum duration for completion of the programme

The maximum period for completion of M.Sc. Degree in Zoology shall not exceed eight semesters.

12. Commencement of regulation

These regulations shall come into effect from the academic year 2019-2020 for students who are admitted to the first year of the course during the academic year 2019-2020.

13. Industrial visit/Internship/Field/Institutional visit:

Students have to undertake an industrial / Internship/Field/ institutional visit/educational tour and have to submit a report for evaluation (Satisfactory / Not Satisfactory).

14. Classification of the successful candidate

A candidate who secured not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First class. All other successful candidates shall be declared to have passed in the Second class. The candidate who obtains 76% of marks in the aggregate shall be deemed to have passed the examination in first class with distinction provide they should have passed all the examination at the first appearance.

Candidates who passed all the examinations prescribed for the course in the first instance and within two academic years from the year of admission to the course are alone eligible for university ranking.

A candidate is deemed to have secured the first rank provided if he/she should have passed all the papers in the first attempt itself and should have secured the highest Cumulative grade point average (CGPA).

Each student should have taken **65 credits** as a core course, **9 credits** as a major elective; **4 credits** as non-major elective, **12 credits** as dissertation work, in addition, MOOCs courses as extra credits, thus totaling at least **90 + extra credits** required to complete M.Sc. Zoology degree programme. Each paper carries **4 /3/ 2** credits with 50% marks in the university examination and 50% marks in CIA.

Raw score	Letter Grade	Description	Grade point
91 and above	S	First Class-Exemplary	9.01-10
76-90	D	First Class-Distinction	7.51-9.00
61-75	A	First Class	6.01-7.50
56-60	B	Second Class	5.51-6.00
50-55	C	Second Class	5.00-5.50
Below 50	RA	Re-appear	-
I - inadequate attendance; W-withdrawal from the course			

M. Sc., Zoology

S. No	Paper Code	Title of the paper		Credits	Hours/Week	Marks		
						I	E	Total
I Semester								
1	509101	Core 1	Animal Diversity – I Invertebrate	4	4	25	75	100
2	509102	Core 2	Animal Diversity – II Chordata	4	4	25	75	100
3	509103	Core 3	Biochemistry	4	4	25	75	100
4	509104	Core 4	Cell and Molecular Biology	4	4	25	75	100
5	509105	Core 5	Lab-I: Animal Diversity I & II, Biochemistry, Cell and Molecular Biology	4	8	25	75	100
6	509501	Major Elective	Endocrinology	3	3	25	75	100
	509502	Major Elective	Animal cell culture technology					
		Library / Yoga/ counselling/Field trip				3		
				23	30	150	450	600
II Semester								
7	509201	Core 6	Animal Physiology	4	4	25	75	100
8	509202	Core 7	Microbiology	4	4	25	75	100
9	509203	Core 8	Immunology	4	4	25	75	100
10	509204	Core 9	Genetics	4	4	25	75	100
11	509205	Core 10	Lab-II: Animal Physiology, Microbiology, Immunology and Genetics	4	8	25	75	100
12	509503	Major Elective	Food Processing Technology (Or)	3	3	25	75	100
	509504	Major Elective	Economic Zoology					
13		Non-Major Elective		2	3	25	75	100
15		Self-learning course (SLC) –MOOCs		Extra credit				
				25	30	175	525	700
III Semester								
16	509301	Core 11	Developmental Biology	4	4	25	75	100
15	509302	Core 12	Ecology and Conservation Biology	4	4	25	75	100
16	509303	Core 13	Evolution	4	4	25	75	100
17	509304	Core 14	Fishery Biology and Aquaculture	4	4	25	75	100
18	509305	Core 15	Lab-III: Developmental Biology, Ecology and Conservation Biology, Evolution and Fishery Biology & Aquaculture	4	8	25	75	100
19	509505	Major Elective	Research Methodology (Or)	3	3	25	75	100
	509506	Major Elective	Entomology					
20		Non-Major Elective		2	3	25	75	100
21		Self-learning course (SLC) –MOOCs		Extra credit				
				25	30	175	525	700
IV Semester								
22	509401	Core 16	Animal Biotechnology	5	5	25	75	100
23	509999	Dissertation Work		12	24	25	75	100
		Library			1			
				17	30	50	150	200
Total				90+		550	1650	2200
				extra credits				

Non-Major Elective –Courses offered to the other Department to other Departments

S. No	Paper Code	Semester	Title of the paper	Credits	Hours/Week	Marks		
						I	E	T
1		II	Immunology	2	3	25	75	100
2		II	Food Processing Technology	2	3	25	75	100
3		III	Fishery Biology and Aquaculture	2	3	25	75	100

Courses:

I Semester = 23Credits (Core: 20; Major Elective: 3)
 II Semester = 25 Credits (Core: 20; Major Elective: 3; Non-Major Elective: 2)
 III Semester = 25 credits (Core: 20; Major Elective: 3; Non-Major Elective: 2)
 IV Semester = 17 credits (Core: 5; Dissertation Work: 12)
Total credits = 90+ Extra credits (Core: 65; Major Elective: 9; Non-Major Elective: 4; Dissertation Work: 12 + MOOCs extra credits)

I Semester				
Course code	509101	Animal Diversity I-Invertebrate	Credits: 4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To study the classification and phylogeny of invertebrate animals. ➤ To understand the general characters, classification, and functions. 			
Unit -I	Classification and Phylogeny of Animal: - Linnaeus and the origin of classification, taxonomic characters, and reconstruction of phylogeny, Molecular taxonomy –Basics and tools. Theories of taxonomy, species, major divisions of life, major subdivisions of the animal kingdom, and animal architecture.			
Unit-II	Protozoa- Euglena, Porifera- Hyalonema, Coelenterata- Aurelia, Ctenophora- Pleurobrachia- General characteristics, classification up to order –type studies.			
Unit III	Platyhelminthes- Fasciola- Liver Fluke, Aschelminthes- <i>Wuchereriabancrofti</i> and Annelida- Earthworm, General characteristics, classification up to order –type studies.			
Unit IV	Arthropoda- Lucifer- Shrimp, Crab, Lobster, Mollusca- Dentallium-General characteristics, classification up to order –type studies. Economic importance of invertebrates with representatives from each phylum - harmful and beneficial.			
Unit V	Echinodermata and Minor phyla- General characteristics, classification up to order –type studies. Economic importance of invertebrates with representatives from each phylum - harmful and beneficial.			
Reference and Text Books: -				
Anderson, D.T. (2002). <i>Invertebrate Zoology</i> . USA: Oxford University Press.				
Barnes, R. D. (2008). <i>Invertebrate Zoology</i> . USA: Cengage Learning (Thompson).				
Eisenhour, D., Larson, A., Keen, S., Roberts, L., Hickman, L. (2009). <i>Animal Diversity</i> , (7 th ed.): McGraw-Hill Education.				
EkambaranathaAyyar, M. (1973). <i>A Manual of Zoology. Part I. Invertebrate</i> : S. ViswanathanPvt. Ltd.				
Hickman, C., Roberts, L., Keen, S., Larson, A & Eisenhour, D. (2009). <i>Animal Diversity</i> ,(5 th ed.): McGraw-Hill, Custom for Oakland University edition.				
Jordan, E.L & Verma, P.S. (2014). <i>Invertebrate Zoology</i> . India: S. Chand & Co. Ltd.				
Sandhu, G.S. (2005). <i>Objective Invertebrate Zoology</i> . New Delhi: Campus Books International.				
Outcomes	The course provides the students comprehensive knowledge and also exhibits depth and breadth of Invertebratel diversity.			

Name of the Course Teacher: **Dr. B.Vaseeharan**

I Semester				
Course code	509102	Animal Diversity II – Chordata	Credits: 4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To study the classification and phylogeny of vertebrate animals. ➤ To understand the general characters, classification, and functions. 			
Unit -I	Taxonomy: Principles of taxonomy Nomenclature- Binomial, Trinomial nomenclature. New trends in taxonomy: Ecological approach, Ethological approach, Cytological approach, Biochemical approach, and Numerical taxonomy.			
Unit-II	Protochordata -General characters of Hemichordata, Urochordata, and Cephalochordata-Organization, phylogenetic considerations, and their larval forms. Retrogressive metamorphosis in Urochordata Pisces :-general characters, classification, structural and functional adaptations of fishes -Chondrichthyes and Osteichthyes and classification up to order Migration in fishes, Osmoregulation			
Unit III	Amphibians and Reptiles: - Definition, general characters, classification, structural, and functional adaptations of amphibians type study – frog- adaptive features of Anura, Urodela&Apoda. Parental care in Amphibians Reptiles: structural and functional adaptations of amphibians - Identification of poisonous and non-poisonous snakes of South India			
Unit IV	Aves: Birds as glorified reptiles. The fossil history of birds. Palate in Birds. Adaptive radiation in birds. Flight Adaptations-Flightless birds and their distribution - Migration in birds. Mammal: Evolution of Mammals, Structural peculiarities of Prototheria, Metatheria, and Eutheria - Flying mammals – Dentition in Mammals- Aquatic mammals			
Unit V	Comparative anatomy: Origin and evolution of the vertebrate integumentary system. Paired fins and limbs, heart and aortic arches, and brain of vertebrates. Zoogeography - Zoogeographical realms, Theories about the distribution of animals.			
Reference and Textbooks: -				
Anderson, D.T. (2002). <i>Invertebrate Zoology</i> . US: Oxford University Press.				
EkambaranathaAyyar, M. (1973). <i>A Manual of Zoology. Part II. Vertebrate</i> : S. ViswanathanPvt. Ltd.				
Ganguly, B.B., Sinha, A.K., &Adhikari, S. (1988). <i>Biology of Animals</i> . Kolkata: New Central Book Agency.				
Hickman, C., Roberts, L., Keen, S., Larson, A & Eisenhour, D. (2009). <i>Animal Diversity, (5th ed.)</i> : McGraw-Hill, Custom for Oakland University edition.				
Jordan, E.L & Verma, P.S. (2013). <i>Invertebrate Zoology</i> : S. Chand & co.				
Kluge, A.G. (1977). <i>Chordate Structure and Function</i> . New York, U.S.A: Macmillan Company. Inc.				
Pandey, B.N, Mathur, Vartika. (2018). <i>Biology of Vertebrate</i> : PHI Learning Pvt. Ltd.				
Outcomes	The course provides the students comprehensive knowledge and also exhibits depth and breadth of Vertebrate diversity.			

Name of the Course Teacher: **Dr. M. Biruntha**

I Semester			
Course code	509103	Biochemistry	Credits: 4 Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To provide knowledge on the core principles and topics of biochemistry. ➤ To understand the structure and function of biomolecules. 		
Unit -I	Protein: - Classification, structure, properties of amino acids, amino acid metabolism, study the specific protein like haemoglobin and myoglobin. Ramachandran plot. Protein metabolism: - Transamination, deamination, urea cycle.		
Unit-II	Carbohydrates: - Classification, properties, and biological importance. Reactions and properties of monosaccharides. Carbohydrate metabolism: - Glycolysis, the formation of acetyl CoA, TCA cycle, HMP shunt, glycogenesis, glycogenolysis, glyconeogenesis and oxidative phosphorylation.		
Unit III	Lipid: -Classification, structure, properties of fatty acids, biosynthesis of triacylglycerol, phospholipids, long chain fatty acid, Oxidation fatty acids, ketogenesis, and its regulations. Nucleic acids: - Structure of bases - nucleosides, nucleotides, and polynucleotides. Biosynthesis of purines and pyrimidines and its regulations.		
Unit IV	Enzymes: - Types, classification and properties of enzymes, enzyme kinetics, enzyme inhibition, enzyme catalysis, coenzymes, enzyme regulation. Vitamins: - Classification, structure and biochemical properties.		
Unit V	Hormones: - Structure, classification, biosynthesis of hormones and their mode of action. Receptors, structure, types and functions. Hormonal regulation and signal transduction.		
Reference and Textbooks: -			
Berg, J. M., Tymoczke, J. L. & Stryer, L. (2007). <i>Biochemistry</i> , (5 th ed.). USA: W.H. Freeman and Company.			
Devlin, T. (Eds.). (2006). <i>Text Book of Biochemistry with Clinical Correlations</i> , (6 th ed.). New Jersey, USA: Wiley-Liss, Hoboken.			
Fromm, H.J., & Hargrove, M. (2012). <i>Essentials of Biochemistry</i> : Springer.			
Murray, R.K., Granner, D. K. & Rodwell, V.M. (2015). <i>Harpers Illustrated Biochemistry</i> , (30 th ed.): The McGraw-Hill Companies, Inc.			
Nelson, D.L. & Cox, M.M. (2010). <i>Lehninger Principles of Biochemistry</i> , (5 th ed.). New York: Worth Publishers.			
Rastogi, S.C. (2010). <i>Biochemistry</i> , (3 rd ed). New Delhi: Tata McGraw Hill Edition. Satyanarayana, U. & Chakrapani, U. (2010). <i>Biochemistry</i> . Kolkata: Books and Allied Pvt. Ltd.			
Satyanarayana, U. & Chakrapani, U. (2010). <i>Biochemistry</i> . Kolkata: Books and Allied Pvt. Ltd.			
Outcomes	By the end of the course, students should be able to critically discuss the core principles and topics of biochemistry with experimental knowledge.		

Name of the Course Teacher: **Dr.V. Nithya**

I Semester			
Course code	509104	Cell and Molecular Biology	Credits: 4 Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To give a firm and rigorous foundation in the principles of cell and molecular biology. ➤ To describe the fundamental process of gene expression and cellular functions. 		
Unit -I	Structure and function of cell organelles: -Cell Membrane, Cell Wall, Nucleus, Mitochondria, Golgi Bodies, Lysosomes, Endoplasmic Reticulum, Peroxisomes, Plastids, Vacuoles, Chloroplast, Structure, and function of the cytoskeleton and its role in motility. Cell Division and Cell Cycle: - Mitosis and Meiosis, their regulation, steps in Cell Cycle, and control of Cell Cycle.		
Unit-II	DNA Structure and Replication, Repair and Recombination: Types of structure and forms of DNA- Organization of chromosomes, general features of chromosomal replication, mechanism of replication, enzymology of replication, synthesis of leading and lagging strands, the difference between prokaryotic and eukaryotic replication. DNA damage and repair mechanisms, homologous, and site-specific recombination.		
Unit III	Regulations of gene expression: - Concept of operon: lac and trp operons, positive and negative control, repressor & inducer, global regulation.RNA synthesis and processing: Transcription and its regulation in prokaryotes and eukaryotes, post-transcriptional modifications & splicing. Translation and it's regulation in prokaryotes and eukaryotes, post-translational modifications. Crisper technology.		
Unit IV	Cellular communication: Regulation of hematopoiesis,general principles of cell communication, cell adhesion, and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission, and it's regulation- Quorum sensing and quenching in microbes.		
Unit V	Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer, and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with healthy cells, apoptosis, therapeutic interventions of uncontrolled cell growth, Immune response to cancer.		
Reference and Text Books: -			
Alberts, B., Bracy, P., Lewis, J., Raff, M., Roberts, K, and Watson, J. (2008). <i>Molecular Biology of the Cell</i> , (5 th ed.). New York: Garland Publishing.			
Karp, G. (2009). <i>Cell and Molecular Biology: Concepts and Experiments</i> , (6 th ed.): Wiley.			
Lewin B. (2004). <i>Genes VIII</i> . Upper Saddle River, N.J: Pearson Prentice Hall.			
Lodish, H., Berk A., Kaiser, C, A., Krieger, M., Scott, M, P., Bretscher A., Ploegh H & Matsudaira, P. (2007). <i>Molecular Cell Biology</i> , (6 th ed.): W. H. Freeman.			
Loewy, A. G., Siekevitz, P., Menningee, J.R & Gallant, J.A.N. (1999). <i>Cell structure and Functions. An Integrated Approach</i> (3 rd ed.): Harcourt College Pub; Subsequent edition.			
Watson, J. D., Baker, T. A., Bell S.P., Gann, A., Levine, M. & Losick, R. (2014). <i>Molecular Biology of the Gene</i> , (7 th ed.): Pearson.			
Weaver, R.F. (2012). <i>Molecular Biology</i> (5 th ed.). New York: McGraw-Hill.			
Outcomes	The students will acquire fundamental ideas on the molecular basis of cellular processes and interrelationship with particular emphasis on prokaryotic and eukaryotic systems.		

Name of the Course Teacher: **Dr.P. Srinivasan**

I Semester				
Course code	509105	Practical -Lab I	Credits: 4	Hours: 8
Objectives	<ul style="list-style-type: none"> ➤ To understand the anatomy (cockroach & frog) using appropriate software. ➤ To provide hands-on training in biochemical techniques and molecular biology (mitotic and meiotic cell division). 			
Unit -I	Animal Diversity-I: -Mounting – Cockroach – Mouthparts, Prawn – Appendages, Placoid scales – Shark. Dissection of cockroach: Digestive, reproductive & nervous systems. Earthworm body setae.			
Unit-II	Animal Diversity –II:- Dissections: -Understanding the anatomy of the frog using an appropriate software package (Carolina™ Biolab ^R – Frog).			
Unit III	Biochemistry: - Preparation of solutions – Molarity, Normality, Percentage - Buffer preparation – Determination of pH. Estimation of glucose, determination of total protein by Lowry et al.			
Unit IV	Biochemistry-Demonstration-separation of amino acid by paper chromatography, Separation of protein by electrophoresis - SDS and Native PAGE.			
Unit V	Cell and Molecular Biology: -Onion root tip-squash preparation and study of mitosis, grasshopper testis- Squash preparation and study of meiosis, Chironomus larva- Squash preparation of giant chromosome and buccal mucosal epithelium-smear preparation to detect Barr body.			
Reference and Text Books: -				
Amsath, A. (2010). <i>Practical Manual in Zoology</i> : M.M.A. Publications.				
Jordan, E.L & Verma, P.S. (2014). <i>Invertebrate Zoology</i> . India: S. Chand & Co. Ltd.				
Lundblad, R. L. & Macdonald, M.F. (2010). <i>Practical Handbook of Biochemistry and Molecular Biology</i> : CRC publications.				
Malik, B.S. (2009). <i>A Laboratory Manual of Veterinary Microbiology</i> : CBS Publications.				
Sambrook, J & Rusell, D, W. (2001). <i>Molecular Cloning: A Laboratory Manual</i> . U.S.A: Cold spring harbor laboratory press.				
Sankara, S. (2008). <i>Laboratory Manual for Biochemistry</i> : Jaypee Brothers Medical Publishers.				
Thompson, D. A & Thompson, C.C. (2011). <i>Cell and Molecular Biology Lab Manual</i> : Create Space Independent Publishing Platform.				
Outcomes	The students can acquire practical exposure related to anatomical dissection (cockroach & frog), biochemistry, microbiology and molecular biology experiments.			

Name of the Course Teachers:

Animal Diversity-1	Animal Diversity-II	Biochemistry & Biochemistry Demonstration	Cell and Molecular Biology
Dr.B.Vaseeharn	Dr.M.Biruntha	Dr.V.Nithya	Dr.P.Srinivasan

I Semester			
Course code	509501	Major Elective -1 Endocrinology	Credits:3 Hours : 3
Objectives	<ul style="list-style-type: none"> ➤ To study the nature, function, and classification of hormones. ➤ To understand the role of hormones in the physiological functions of the human system. 		
Unit -I	Endocrinology: -Scope, Nature, function, and classification of hormones – Feedback control of hormone secretion – hormonal rhythms, Organisation, and functions of neuroendocrine systems-cause of hormone excess and deficiency.		
Unit-II	Hypothalamus, Pineal, and Pituitary: -Hypothalamus –structure and functions -Pineal gland- the structure and its functions. Pituitary - Hormones from anterior and posterior pituitary-Disorder of Pituitary.		
Unit III	Thyroid, Parathyroid , and Thymus Glands: — Thyroid gland – Structure, function, and biosynthesis of thyroid hormone - Disorders of the thyroid gland- Parathyroid – Structure, and PTH – Calcitonin – Role of hormones in calcium and phosphate metabolism. Thymus gland – Structure and thymic hormones – their functions and Disorders.		
Unit IV	Gastrointestinal and Adrenal hormones: Gastrointestinal hormones - their secretion, control, and function – Insulin and glucagons – Obesity –Diabetes mellitus-Hypoglycaemia- Disorders of lipoprotein metabolism -Adrenal gland – Structure and functions of hormones–Adrenal disorders.		
Unit V	Gonadal Hormones: Steroid hormone biosynthesis in the ovary and testis – Hormonal regulation of ovarian cycles in mammals –Hormones in pregnancy and lactation. Disorders sex development –a disorder of the testes –testicular cancer –female reproductive system: Infertility and contraception –Menstrual disorder- Sexual dysfunction.		
Reference and Text Books: -			
Goswami, M.P. (2013). <i>Endocrinology and Molecular Cell Biology</i> . Delhi: Gaurav book centre Pvt Ltd.			
Griffing, G & Padilla, M. (Eds.). (2015). <i>Endocrinology: Specialty Review and Self- Assessment, Stat Pearls Publishing, (3rd ed.)</i> . USA: Stat Pearls Publishing LLC.			
Melmed, S., Polonsky, K., Larsen, R.P., Kronenberg, H. (2015). <i>Williams Textbook of Endocrinology, (13th ed.)</i> : Elsevier			
Nussey, S. & Whitehead, S. (2001). <i>Endocrinology - An Integrated Approach</i> . Oxford: BIOS Scientific Publishers.			
Victor W. Rodwell., David A. Bender., Kathkeen, M., Kennelly, P., Antony, Weil. (2018). <i>Harper's Illustrated Biochemistry (31th ed.)</i> : McGraw Education.			
Williams, R. H. (2011). <i>Textbook of Endocrinology, (12th ed.)</i> : Elsevier.			
Yadav, P. R. (2009). <i>Textbook of Endocrinology</i> . New Delhi: Sonali Publications, Discovery Publishing House Pvt. Ltd.			
Outcomes	On successful completion of the course, the student will be able to acquire in-depth knowledge on the endocrinology.		

Name of the Course Teacher: **Dr. N. M.Prabhu**

I Semester			
Course code	509502	Major Elective -2 Animal Cell Culture Technology	Credits:3 Hours : 3
Objectives	<ul style="list-style-type: none"> ➤ To impart basic knowledge of animal cell culture. ➤ To teach the possible and obstacles during cell growth and development. 		
Unit -I	Introduction to Animal Cell culture: - Structure and Organization of animal cell; History, advantages of tissue culture, limitations, a significant difference <i>in vitro</i> ,-types of culture, and biology of cultured cells.		
Unit-II	Laboratory designing and components – Equipment and materials, aseptic technology, safety, bioethics and validation, culture vessels, and substrates – define media and supplements and serum free media.		
Unit III	Basic techniques <i>in vitro</i> :- Primary and established cell lines, measuring parameters of growth.Disaggregation of tissue and primary culture, Measurement of viability and cytotoxicity, apoptosis – characteristic features and molecular mechanisms.		
Unit IV	Specialized cells: Epithelial cells –Breast, cervix, liver, colon; Mesenchymal cells – bone and cartilage; neurodermal cells –neurons and glial cells, gonads. Stem cell cultures embryonic and adult stem cells and their applications. Cell cultured based vaccines.		
Unit V	Three-dimensional culture :- Organ, histotypic, organotypic, and imaging cells in 3D constructs-Applications of animal cell culture technology (CEF culturing).		
Reference and Text Books: -			
Butler, M. (2003). <i>Animal cell culture and Technology</i> : Taylor & Francis.			
Butler, M. (2003). <i>Animal Cell Culture, Essential techniques</i> : Taylor & Francis.			
Castilho, L., Moraes, A., Augusto, E., Butler, M. (2008). <i>Animal cell technology: from biopharmaceuticals to gene therapy</i> , (1 st ed.): Taylor & Francis.			
Ian Freshney, R.(2010). <i>Culture of animal cells: A manual of basic technique and specialized applications</i> , (6 th ed.): Wiley-Blackwell.			
John, R & Masters, W. (2000). <i>Animal cell culture: A practical approach</i> , (3 rd ed.): OUP Oxford Publishers.			
Pinkert, C.A. (2012). <i>Transgenic animal technology: a laboratory handbook</i> , (2 nd ed.): Academic Press.			
Wilson Aruni, A & Rramadass, P. (2011). <i>Animal tissue culture</i> : MJP Publishers.			
Outcomes	The students will gain theoretical knowledge of basic techniques in animal cell culture and to familiarize safety procedures needed for tissue culture.		

Name of the Course Teacher: **Dr. P. Kumar**

II Semester			
Course code	509201	Animal Physiology	Credits:4 Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To elaborate on the physiological function of animal tissue and organ systems. ➤ To study the basic physiological principles common to humans and other animals. 		
Unit -I	Introduction to Physiology: - Definition-division of physiology- Relationship of physiology with other science-significance of the study. Digestive system: - Nutritional value, Digestion, absorption, energy balance, gastrointestinal enzymes. Respiratory system: - Respiratory pigments, transport, and exchange of respiratory gases waste elimination. Blood: - Blood corpuscles, plasma function, blood volume and regulation, blood groups, haemoglobin.		
Unit-II	Cardiovascular System: - Comparative anatomy of heart structure, myogenic heart, ECG - its principle and significance, heartbeat and cardiac cycle, blood pressure. Excretory system: - kidney, structure and function of nephron, urine formation, urine concentration, waste elimination, regulation of water balance, electrolyte balance, acid-base balance.		
Unit III	Muscle contraction: - General structure and types of muscles. Ultrastructure of skeletal muscle. Mechanism of muscle contraction. Chemical changes during muscle contraction. Nervous system: - Neurons, nature of nerve impulse – resting potential and action potential, neurotransmitters central and peripheral nervous system, the structure of the synapse, mechanism of synaptic transmission – electrical and chemical transmissions. Sensory organs: - Vision, hearing and tactile response.		
Unit IV	Homeostatic Mechanisms: - Thermoregulation in poikilotherms and homeotherms - Tolerance to high temperature, cold and freezing - Physiology of hibernation and aestivation. Osmotic and ionic regulation, Hormonal control of osmoregulation: Adaptation to pressure: High altitude - buoyancy.		
Unit V	Endocrinology and reproduction: - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation. Animal behavior: - Biological clock – endogenous rhythm – the circadian rhythm – circannual and lunar periodicity.		
Reference and Text Books: -			
Linda S. Costanzo. (2017). <i>Physiology</i> , (6 th ed.): Elsevier.			
Rastogi, S. T. (1988). <i>Essentials of Animal Physiology</i> . Madras: Wiley, Eastern Limited.			
Richard W. Hill., Gordon A. Wyse., Anderson, M. (2008). <i>Animal Physiology</i> , (2 nd ed.): Sinauer Associates, Inc.			
Richard W. Hill., Gordon A. Wyse., Anderson, M. (2012). <i>Animal Physiology</i> , (3 rd ed.): Sinauer Associates, Inc.			
Schmidt Nielson, K. (2002). <i>Animal Physiology – Adaptation and Environment</i> . Cambridge: Cambridge Press.			
Verma, P. S, Tyagi, B.S & Agarwal, U.V. (2005). <i>Animal Physiology</i> . New Delhi: S. Chand & Company Ltd.			
Williams S, Hoar. (1966). <i>General and Comparative Physiology</i> . New Delhi: Prentice-Hall of India.			
Outcomes	After completion of the course, students understand the structure and functions of human systems.		

Name of the Course Teacher: **Dr. M. Biruntha**

II Semester				
Course code	509202	Microbiology	Credits:4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To gain knowledge on microorganisms associated with infectious diseases ➤ To adopt aseptic techniques and develop skills necessary to handle microbes in the laboratory 			
Unit -I	Scope of Microbiology: - History, microbial diversity, microalgae, fungi, bacteria and viruses, size, shapes and pattern of arrangement. Ultrastructure of bacteria, gram-positive and gram-negative bacteria.			
Unit-II	Bacterial Growth and Nutrition: - Types of culture media for bacteria, fungi and virus, growth curve, nutritional requirements. Nutritional types, enumeration, isolation, identification of microbes by biochemical and molecular tools. Storage of microbes.			
Unit III	Bacterial and Viral-associated diseases: -ruminant, small ruminant, poultry, swine – Introduction -history –symptoms- diagnosis –control. Zoonotic diseases.			
Unit IV	Fungi and Associated Diseases: -Cutaneous infections, subcutaneous infections, systematic infections, opportunistic mycoticinfectionsprimaryandmycotoxicoes infections in Ruminant – small ruminant – poultry and swine –Introduction –history – symptoms –diagnosis-control.			
Unit V	Beneficial Microbes: - History and definition of Probiotic's, production and application in health management, prebiotics and symbiotic. Microbes of milk and food - methods of detection, Pasteurization and food poisoning; food preservation. Algae and algal toxins.			
Reference and Text Books: -				
Carter, G.R., Darla, J. Wise. (2004). <i>Essentials of Veterinary Bacteriology and Mycology</i> . (6 th ed.): Wiley-Blackwell.				
Hirsh, D. C., Maclachlan, N. J., Walker,R.L. (2004). <i>Veterinary microbiology</i> , (2 nd ed.):Wiley - Blackwell Publishers.				
James G. Fox, Lynn C. Anderson, Franklin M. Loew, & Fred W. Quimby. (2002). <i>Laboratory Animal Medicine</i> , (2 nd ed.) (<i>American College of Laboratory Animal Medicine</i>): Animal Medicine Series.				
Joanne M.Willey, Linda M.Sherwood, Christopher. (2011). <i>Prescott's Microbiology</i> , (8 th ed.).Mcgraw: Hill International Edition.				
Knols, B.G.J & Louis, C. (2006). <i>Bridging Laboratory and Field Research for Genetic Control of Disease Vectors (Wageningen UR Frontis Series)</i> : Springer, Netherlands.				
Mettenleiter, T. C., &Sobrino, F. (2008). <i>Animal Viruses: Molecular Biology</i> . Norfolk, UK: Caister Academic Press.				
Quinn, P.J., Markey, B. K., Leonard, F. C., Hartigan, P., Fanning, S., Fitz Patrick, E.S. (2011). <i>Veterinary Microbiology and Microbial Disease</i> ,(2 nd ed.): Wiley-Blackwell				
Outcomes	At the end of the study, students will develop fundamentalknowledge on microbial pathogens and its control measures in addition to this beneficial microbes and its importance in health management			

Name of the Course Teachers: **Dr. E. Kannapiran&Dr. N. M. Prabhu**

II Semester				
Course code	509203	Immunology	Credits:4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To understand the fundamental concepts of immunology and immunotechnology ➤ To provide in-depth ideas on innate and adaptive immunity mechanism and their response. 			
Unit -I	Introduction: History and scope of Immunology, Tissues, and organs of the immune system - structure and function. Molecules of the immune system - antibodies, complements, cytokines, interferons - types, sources, and functions. Antigen: classification, epitopes, antigen and antibody interaction.			
Unit-II	Innate and adaptive immunity: - Elements of the immune system: Hematopoiesis, T-cells, B-cells, myeloid cells, antigen presenting cells, cell-mediated subset of T-Cells, helper and suppressor cells, cell-mediated and humoral immunity, antibody-dependent cell-mediated cytotoxicity, natural killer cells.			
Unit III	Immune response: -Mechanism of humoral and cell-mediated immune responses - immunity to infections - immunoprophylaxis, vaccines and immunization schedule. Immunological disorders.			
Unit IV	Disease & Immune response: - Infectious diseases, hypersensitivity - Types I, II, III and IV; autoimmune disorder; immunodeficiency diseases. Tumour and transplantation immunology - Major histocompatibility complex (MHC), immunotherapy for the treatment of cancer.			
Unit V	Immune techniques: Immunocytochemistry, Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, Acquired Immuno Deficiency Syndrome (AIDS) test, hybridoma technology, radioimmunoassay.			
Reference and Text Books: -				
Blaine T. Smith. (2008). <i>Concepts in Immunology and Immunotherapeutics</i> , (4 th ed.): American Society of Health-System Pharmacists.				
Chapel, H., Haeney, M., Misbah, S., & Snowden, N. (2014). <i>Essentials of Clinical Immunology</i> , (6 th ed.): Willey Blackwell Publishing.				
Kannan, I. (2013). <i>Immunology</i> : MJP Publication.				
Male, D., Brostoff, J., Roth, B, D & Roit, I. (2012). <i>Immunology</i> , (8 th ed.): Elsevier.				
Owen, J., Jenni Punt, Sharon Stranford. (2013). <i>Kuby Immunology</i> , (7 th ed.): W. H. Freeman.				
Thomas J. Kind., Richard A. Goldsby., Barbara A. Osborne., Kubi, J. (2000). <i>Kuby Immunology</i> . New York: W.H. Freeman.				
Vaman Rao., (2016). <i>Immunology</i> . New Delhi: Narosa Publishing House Pvt, Ltd.				
Outcomes	The course will provide basic mechanisms, distinctions and functional interplay of innate and adaptive immunity.			

Name of the Course Teacher: **Dr.B.Vaseeharan**

II Semester			
Course code	509204	Genetics	Credits:4 Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To study the “science of heredity” and molecular process of gene expression. ➤ To examine qualitative genetic data and describe the evolution of the population. 		
Unit -I	Introduction: - Definitions, the scope of genetics, Mendelian principles and contribution, polygenic inheritance, multiple alleles, sex determination, sex-linked inheritance and pedigree analysis, simple Mendelian traits in man, twin study.		
Unit-II	Chromosomes: - Chromosome mapping, aneuploidy, euploidy, haploidy and polyploidy, with practical applications. Human chromosome: - Sex chromosome, heterochromatinization, Barr bodies and chromosomal abnormalities. Gene mapping methods, linkage maps, tetrad analysis, mapping with molecular markers. QTL mapping.		
Unit III	Molecular genetics: - Concept of gene-gene expression, gene expression control in eukaryotic, prokaryotes and phages. DNA mutation and recombination. Genetic regulation of development and differentiation—a sequential expression of genes with examples from <i>Drosophila</i> , <i>C. elegans</i> and Zebrafish.		
Unit IV	Evolutionary genetics: - Theory of natural selection - genetic and non - genetic variations - evidence for the role of natural selection - polymorphism and selection. Neo – Lamarckism - present concept of recapitulation. Origins of unicellular and multicellular organisms; major groups of animals; stages in primate evolution including Homo sapiens.		
Unit V	Genetic concepts: - Neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; the origin of new genes and proteins; gene duplication and divergence. Population genetics – gene pool, gene frequency; Hardy - Weinberg law random genetic drift, founder principle. Concepts, approaches and methods in the study of behavior - biological clocks.		
Reference and Text Books: -			
Crew, F. A., (2006). <i>Animal Genetics - The Science of Animal Breeding, (1st ed.)</i> : Home Farm Books.			
Emmanuel, C. (2006). <i>Applied genetics: Recent trends and Techniques, (1st ed.)</i> : MJP Publishers.			
Gahalain, S. S. (2004). <i>Fundamentals of Genetics</i> . India: Anmol Publications Pvt.			
Hartwell, L., Hood, L., Goldberg, M., Reynolds, A. E., Silver, L. (2014). <i>Genetics from genes to genomes. (5th ed.)</i> : McGraw-Hill Education.			
Joe Bearden H., John W. Fuquay., & Scott T. Willard. (2003). <i>Applied Animal Reproduction, (6th ed.)</i> : Pearson			
Richard M. Bourdon. (1999). <i>Understanding Animal Breeding, (2nd ed.)</i> : Pearson.			
Terence A. Brown. (1990). <i>Genetics: a molecular approach</i> : Chapman and Hall.			
Outcomes	The students will understand the concepts of Mendelian, molecular and genetic concepts.		

Name of the Course Teachers: **Dr. V. Nithya**

II Semester					
Course code	509205	Practical -Lab II		Credits:4	Hours: 8
Objectives	<ul style="list-style-type: none"> ➤ To demonstrate the practical applications of physiology, microbiology, immunological techniques and genetics. ➤ To study the molecular genetics of <i>Drosophila</i> and their mutants. 				
Unit -I	Animal Physiology: - Estimation of salivary amylase activity, ammonia, urea, blood chloride and dissolved oxygen.				
Unit-II	Microbiology: - Lab safety procedures and basic microbiological techniques, Methods of sterilization and culture media preparation, techniques for isolating bacteria from animal sources: different culture methods, identification - Colony morphological characterization – differential straining.				
Unit III	Immunology: - ABO blood group identification, Study of lymphoid organs, Haemagglutination assay.				
Unit IV	Immunotechnology: -Study of antibody titer values, Immunodiffusion – Single / Double and Immunoelectrophoresis. ELISA and Western Blot.				
Unit V	Genetics: - <i>Drosophila</i> culture – Identifications of sex & pictorial representation of mutants, Multiple alleles.				
Reference and Text Books: -					
Frank C. Hay., Olwyn, M., Westwood, R. (2002). <i>Practical Immunology</i> , (4 th ed.): Blackwell Science, Ltd.					
Ghai, C, L. (2007). <i>A textbook of practical physiology</i> , (8 th ed.): Jaypee Brothers Medical Publishers.					
GutaTalwar. (2006). <i>A Handbook of Practical and Clinical Immunology, Volume II</i> . New Delhi. CBS Publishers.					
Miller, H.J. (1992). <i>A short course in bacterial genetics – A laboratory manual and handbook for E.coli and related bacteria</i> : Cold Spring Harbour Laboratory Press.					
Nicholas H. Barton., Derek E. G. Briggs., Jonathan A. Eisen., David B. Goldstein., Nipam H. Patel. (2007). <i>Evolution</i> , (1 st ed.): Cold Spring Harbor Laboratory Press.					
Sambrook, J., Fritsch, E.F., Maniatis, T. (1989). <i>Molecular cloning volumes-3</i> : Cold Spring Harbour Laboratory.					
Talwar, G.P & Gupta, S.K. (2012). <i>A Handbook of Practical and Clinical Immunology</i> (2 nd ed.). New Delhi: CBS Publishers.					
Outcomes	The students gain hands-on knowledge of physiology, immunology, microbiology, and molecular genetics techniques.				

Name of the Course Teachers				
Animal Physiology	Microbiology	Immunology	Immunotechnology	Genetics
Dr.M.Biruntha	Dr.E.Kannapiran & Dr.N.M.Prabhu	Dr.B.Vaseeharan	Dr.B.Vaseeharan	Dr.V.Nithya

II Semester				
Course code	509503	Major Elective –3 Food Processing Technology	Credits: 3	Hours: 3
Objectives	<ul style="list-style-type: none"> ➤ Students who have completed this course will have a full understanding of the Nutritional quality of meat, poultry, and seafood. Methods of preserving and Quality control and standardization. ➤ To explain the students with various operations of food processing 			
Unit I	Diary Processing –Milk collection –Pre-processing –Processing and Preservation- National and International status of dairy processing -Pasteurization- freezing – refrigeration –Drying and dehydration and nutritional standards-Production cost analysis and marketing.			
Unit II	Meat and Poultry processing –National and international status –Pre-processing –Processing and preservation –a different method of processing -nutritional standards –Production cost analysis and marketing.			
Unit III	Seafood Processing- National and international status –Pre-processing – Processing and preservation – a different method of processing- Chilled fish processing -smoking-canning –drying –IQF -Nutritional standards -Production cost analysis and marketing.			
Unit IV	Miscellaneous food processing – Fruit-collection –pre-processing –Processing and storage-nutritional standards- vegetables-collection -pre-processing – Processing and storage-nutritional standards.			
Unit V	Food safety – History of food regulation –International and national Standards-Food adulteration acts-meat food production Orders-Milk & milk product amendment regulations –Food quality assurance and control- sensory evaluations for various products, sanitary procedures –HACCP –GMP.			
Reference and Text Books: -				
Clark, S., Jung. & S., Lamsal, B. (Eds.). (2014). <i>Food processing principles applications</i> , (2 nd ed.). US: Wiley Publishers.				
Fellows, P.J., (2000). <i>Food processing technology. Principles and practices</i> , (3 rd ed.).Wood head Publishing: Elsevier.				
<i>Food safety and standards regulations</i> (2010). Ministry of health and family.				
John R. Campbell &Robert T. Marshall. (2016). <i>Dairy Production and Processing: The Science of Milk and Milk Products</i> , (1 st ed.): Waveland Press.				
Pearson, A. M. (1994). <i>Quality attributes and their measurements in meat poultry</i> . Food Science & Nutrition: Springer.				
Richardson, R. I & Mead, C. (1999). <i>Poultry meat science</i> , (1 st ed.): CABI Publishing.				
Walstra, P., Wouters, J.M. Jan, Geurts, J. T. (2005). <i>Dairy Science and technology</i> : CRC Press.				
Outcomes	After completing this course, students acquired knowledge about the food processing technology of meat, poultry, fish, and seafood. Additionally they gain knowledge on Quality control quality assurance and standards of food safety			

Name of the Course Teacher: **Dr. N. M. Prabhu**

II Semester				
Course code	509504	Major Elective 4 Economic Zoology	Credits: 3	Hours: 3
Objectives	<ul style="list-style-type: none"> ➤ To study the importance of animal husbandry. ➤ To know culture practices and economic importance sericulture, apiculture and aquaculture 			
Unit I	Agriculture and Livestock: Beneficial insects: spider, mantis, ladybird beetle, damselfly, mealybug destroyer, soldier beetle, green lacewing, syrphid fly, tachinid fly, ichneumon wasp and Trichogramma wasp- Important livestock – cattle, goat, sheep, dog, and rabbit - Establishment of Zoo and its importance			
Unit II	Dairy and poultry production: Status –national and international-dairy farming – types – production systems- farm management. Poultry –types –broiler and layer – type of farming and management			
Unit III	Sericulture and Apiculture: Classification-biology of silkworm, silk gland, cultivation of mulberry plants, rearing silkworm and uses of silk –current status of the silk industry. Apiculture: types and classification of bees, status and economics of honey production-bee colony, life history, Beekeeping accessories – honey production methods –honey collection –preservation and by-products of bees and its uses.			
Unit IV	Freshwater aquaculture: cultivable species -Finfish and prawn hatchery- types and classification –nation and international status. Farming practices –monoculture, composite culture, polyculture. Ornamental fish culture –National and international status-economically important species, aqua-phonics, organic farming and spirulina culture.			
Unit V	Integrated farming: Importance –national and international status- a different type of integrated farming systems. Production cost analysis of different integrated farming systems.			
Reference and Text Books: -				
Aminul, I. (2016). <i>A Textbook of Economic Zoology</i> : I.K International publication house, Pvt. Ltd.				
Jabde, P.V. (2005). <i>Text Book of Applied Zoology, Vermiculture, Apiculture, Sericulture, Lac-Culture, Agricultural Pests and Their Controls</i> : Discovery Publishing Group.				
Jadhav, N.V & Siddiqui, M.F. (2007). <i>Handbook of Poultry Production and Management</i> : Jaypee Brothers Medical Publishers.				
Kotpal, R. L. (2014). <i>Modern Textbook of Zoology</i> : Rastogi Publications.				
Pillay, T. V. R&Kutty, M. N. (2005). <i>Aquaculture: Principles and Practices, (2nd ed.)</i> : Wiley-Blackwell.				
Pradip. V Jabde, (2008). <i>Text Book of Applied Zoology</i> : Discovery Publishing House.				
Shukla, G.S & Upadhyay, V.B. (2006). <i>Economic Zoology</i> : Rastogi Publications.				
Outcomes	Learners would gain insight into livestock production, freshwater aquaculture, and integrated farming.			

Name of the Course Teachers: **Dr.N.M.Prabhu, Dr.M.Biruntha&Dr.P.Kumar**

III Semester			
Course code	509301	Developmental Biology	Credits:4 Hours: 4
Objectives	➤ To understand and master the basic concept of developmental biology, genes and development.		
Unit -I	Basic concepts of development Biology:- Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in the analysis of development.		
Unit-II	Gametogenesis, FertilizationCleavage:- Spermatogenesis and oogenesis – Sperm structure and physiology, classification of eggs - Polarity and symmetry – Maturation of egg- egg envelopes – vitellogenesis, Types of eggs. Egg recognition, gamete fusion and prevention of polyspermy, activation of egg metabolism – Types of cleavage – Factors affecting cleavage – Chemodifferentiation – Blastulation – Types of blastula – Presumptive organ forming areas in frog and chick – Fate maps.		
Unit III	Gastrulation in animals:- Gastrulation in fish, chick and mammals, epiboly, emboly. Germ cell determination and migration, morphogenetic movements, the cellular basis of morphogenesis, cell motility and differential cell affinity.		
Unit IV	Morphogenesis and organogenesis in animals:- Cell aggregation and differentiation in <i>Dictyostelium</i> ; axes and pattern formation in <i>Drosophila</i> , amphibia and chick; organogenesis – vulva formation in <i>Caenorhabditis elegans</i> ; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, postembryonic development – larval formation, metamorphosis; environmental regulation of normal development.		
Unit V	Genes and development:- Nuclear transplantation, differential gene activation, developmental genetic defects, the role of cell death in development, factors involved in teratogenesis, the concept of assisted reproductive technologies (ART).		
Reference and Text Books: - Gilbert, S. F & Knisely, K. (2009). <i>Developmental Biology</i> : Sinauer Associates, Inc. Hake, S & Wilt, F. (2003). <i>Principles of Developmental Biology</i> : W.W. Norton & Co. Hodge, R. (2009). <i>Developmental Biology (Genetics and Evolution)</i> : Facts on File. Jonathan M. W. Slack, (2006). <i>Essential Developmental Biology</i> : Blackwell Publishing Ltd. Minelli, A. (2009). <i>Forms of Becoming: The Evolutionary Biology of Development</i> : Princeton University Press. Subramanian, M.A. (2012). <i>Developmental Biology</i> : MJP Publications. Wolpert, L., Beddington, R., Jessell, T., Lawrence, P., Mayerowitz, E. & Smith, J. (2002). <i>Principles of development</i> . UK: Oxford University Press.			
Outcomes	On successful completion of this course, students should be able to critically discuss the concepts principles and scope of developmental Biology.		

Name of the Course Teacher: **Dr. S. Subeena Begum**

III Semester				
Course code	509302	Ecology and Conservation Biology	Credits: 4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To understand the dynamics of the ecosystem and inter-relationship between organisms. ➤ To learn the fundamentals of biodiversity and gain insights on the values of wildlife and conservation. 			
Unit -I	Ecosystem: Definition and concept of the ecosystem - Tropic structures in the ecosystem. Ecological complexity and stability in food webs. Ecological pyramids - food chain and their significance. Biotic features of Terrestrial Ecosystem. Bio-geochemical cycle: Definition, General concept of complete and incomplete bio-geochemical cycles, sedimentary cycles in tropics.			
Unit-II	Population and community ecology: Population concept- Natality, mortality, growth rate, population density & age distribution. Community structure - the influence of competition - the influence of predation and disturbance			
Unit III	Freshwater, estuarine and marine ecosystem -Biotic features of a freshwater ecosystem. Estuarine and marine ecosystem-classifications, biological features of Coral Reefs, Seaweeds, Seagrasses and Mangroves. Natural resources and their conservation- Satellite mapping.			
Unit IV	Environmental Pollution and Management: Types of environmental pollution (Air, Water, Soil, Noise). Effect of climate change, global warming and its effect on living organisms - Role of microbes in bioremediation. Organizations involved in environmental protection. Environmental laws.			
Unit V	Conservation Biology and Biodiversity: Species and speciation; Extinct Species; Ethics and conservation; Conceptual framework of Biodiversity. Values of biodiversity, Global Hot-spots of biodiversity-Principles and concepts - Wildlife sanctuaries and National parks threatened species (IUCN categories), Keystone species, Flagship species, Indicator species, Surrogate Species. Threats to biodiversity and conservation of biodiversity-Role of NGO's in conservation – Case studies (Project Tiger and Elephant) - Legal framework of biodiversity conservation.			
Reference and Text Books: -				
Calver, M., Lymbery, A., McComb, J. (2009). <i>Environmental Biology</i> : Cambridge University Press.				
James W. Nybakken. (1996). <i>Marine biology –An Ecological approach(4th ed.)</i> :Harpercollins College Div.				
Khanna, D.R., Chopra, A.K., Vikas Singh, GaganMatta&Rakesh Bhutiani. (2013). <i>Environmental Pollution: Assessment and Control techniques</i> : Biotech Books.				
Odum, E.P. & Gary W, Barrett. (2004). <i>Fundamentals of Ecology</i> . USA:Cengage Learning (Thompson).				
Rupeet Kaur. (2006). <i>General Issues on Environment, Biodiversity and Climate Change</i> : New Vishal Publication.				
Sandhya, J. (2008). <i>Environmental Biology and Biotechnology</i> : Vision Publications				
Smith, T. M & Smith, R. L. (2008). <i>Elements of Ecology,(7th ed.)</i> :Benjamin Cummings.				
Outcomes	Students gain knowledge of ecological principles/concepts and concise critical thinking to solve problems in ecology and concervation biology.			

Name of the Course Teachers: **Dr.N.M.Prabhu&Dr.P.Kumar**

III Semester				
Course code	509303	Evolution	Credits: 4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To understand the fundamental concepts, principles and process of evolution, evolutionary significance and the universal tree of life. ➤ To create knowledge on nature and origin of species. 			
Unit -I	Molecular and biological evolution: - Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Evolutionary significance of Protein and nucleotide sequence; the origin of new genes and proteins; Gene duplication and divergence.			
Unit-II	The universal tree of life: - From single-celled organisms to kingdoms, Eukaryotic cells and multicellular organisms, branch of the tree of life - plant, fungi and animals.			
Unit III	Principles and processes of evolution:- Individual genetic variation and gene regulation, genetic variation in population, biology of population, natural selection.			
Unit IV	Nature and origin of species: - Species and similarity, the origin of species, mass extinctions and adaptive radiation. Speciation – causes and modes – geographical and reproduction isolation, Cospeciation.			
Unit V	Human origin and evolution: - Culture and social evolution, religion and evolution. Fossils – paleontological evidence – geological (carbon) dating methods, types of fossils, significance, Geological time scale, drift molecular clock.			
Reference and Text Books: -				
Brian K. Hall. (2010). <i>Evolution: Principles and Processes</i> : Jones & Bartlett Publishers.				
Buss, D.M. (2003). <i>The evolution of desire. Strategies of human mating</i> : Basic Books.				
Futuyma, D. J. (2006). <i>Evolutionary biology</i> . Sinauer Associates Inc: Subsequent edition.				
Harvey, P.H & Pagel, M.D. (1991). <i>The comparative method in evolutionary biology (Vol. 239)</i> . Oxford: Oxford university press.				
Monroe W. Strickberger. (2000). <i>Evolution</i> : Jones & Bartlett Publishers.				
Nicholas H. Barton., Derek E. Briggs G., Jonathan A. Eisen., David B. Goldstein., Nipam H. Patel. (2007). <i>Evolution. Cold Spring, (1st ed.)</i> : Harbor Laboratory Press.				
Travis, J. (2016). <i>Evolutionary Biology: Genome Evolution, Speciation, Coevolution and Origin of Life</i> . Pierre Pontarotti (Eds.). Cham (Switzerland) and New York: Springer.				
Outcomes	On successful completion of this course, students should be able to discuss the concepts, principles and scope of evolution.			

Name of the Course Teacher: **Dr. P. Srinivasan**

III Semester				
Course code	509304	Fishery Biology and Aquaculture	Credits: 4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To familiarize basic information about fishery biology, resources, management and necessary skills to identify fish species ➤ To provide technical knowledge about recent aquaculture practices. 			
Unit -I	Fishery Biology: - General classification of fishes, economically important marine and freshwater fishes about their fishery potential. Indigenous and modern craft and gears used for capture fisheries. Morphometric and meristic characters of fishes, food and feeding habits, age and growth, reproduction and spawning - Migration in fishes -Fishery by-products.			
Unit-II	Fishery conservation: -Recent concepts in fisheries management - Endangered species management - Invasive species. <i>In situ</i> and <i>Ex-situ</i> conservation - Management of fisheries operations - Post-harvesting technology - Physical and biochemical methods to examine freshness of fish and various processing methods, Quality control – HACCP- Food safety.			
Unit III	Aquaculture: - Definition- Status of aquaculture in the world and India. Broodstock sourcing and collection methods - cultivable organisms - classification - various culture systems - a type of culture. Aquaculture engineering - design - earthen ponds, cage, pen structure and construction.			
Unit IV	Hatchery Management: -Type of hatchery, brood stock – induce breeding -larval production - feed management - water quality and disease management in cultivable species - Live feed production. Bio-security, SPF, HACCP, GMP systems in the hatchery.			
Unit V	Farm Management- Water quality, feed and disease management in freshwater and marine cultivable species - Intensive culture system - raceway - open and closed culture systems, Biosecurity, HACCP, GMP and Bio-floc technology - integrated farming – Organic Farming- Feed production.			
Reference and Text Books: -				
Agarwal, S.C. (2007). <i>A Handbook of fish farming, (2nd ed.)</i> : HB.				
Chakrabarty, (2010). <i>Biology, Breeding and Farming of Important Food Fish</i> : HB.				
Gopakumar, K. (2002). <i>Fish processing technology</i> , ICAR. New Delhi: Directorate of information and Publications of Agriculture, Indian Council of Agricultural Research.				
Jean T. Nolan. (2009). <i>Offshore Marine Aquaculture</i> :Nova Science Pub Inc.				
Khanna & Singh. (2012). <i>A Text Book of Fish Biology and Fisheries</i> : Narendra Publication.				
Michael, K. (2007). <i>Fisheries Biology, Assessment and Management</i> : Blackwell Publishers.				
Pillay, T. V. R&Kutty, M. N. (2005). <i>Aquaculture: Principles and Practices, (2nd ed.)</i> : Wiley-Blackwell.				
Outcomes	On successful completion of this course, students should be able to discuss the fundamental concepts of fishery biology critically. Critically discuss the challenges and recent trends of aquaculture practices.			

Name of the Course Teachers:

Fishery Biology: **Dr. E. Kannapiran**; Aquaculture: **Dr. N. M.Prabhu**

III Semester				
Course code	509305	Practical -Lab-III	Credits: 4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To provide practical knowledge on developmental biology, ecology and conservation biology ➤ To educate students in identifying commercially important fishes and to teach them with best aquaculture management practices. 			
Unit -I	Developmental Biology:- Identification of gametes in vertebrates and invertebrates. Egg, 24 hrs, 36 hrs, 48 hrs, 72 hrs and 96 hrs developmental stages in the chick.			
Unit-II	Ecology and conservation biology:- Estimation of salinity, Estimation of dissolved oxygen and Carbon dioxide, identification of plankton (freshwater/marine) and Animal associations.			
Unit III	Evolution:- Animals of evolutionary importance – Analogous and homologous organs, fossils, mimicry, coloration.			
Unit IV	Fishery Biology:- Identification of commercially important fin fishes, shellfishes, molluscs, lobsters and seaweed. Morphometric and meristic characters. Modern crafts and gears. Estimation of protein, lipid carbohydrate and salt content in fishes.			
Unit V	Aquaculture: Determination of stocking density and feed assessment, Method of transportation of seeds.			
Reference and Text Books:-				
Glover, D.M & Hames, B.D. (1995). <i>DNA Cloning, (2nd ed.), Volume - I, II, III.</i> New York: IRL Press at Oxford University Press.				
Ian Freshney, R. (2005). <i>Culture of Animal Cells: A Manual of Basic Technique, (5th ed.):</i> Wiley Publisher.				
Jean T. Nolan. (2012). <i>Offshore Marine Aquaculture</i> :Nova Science Pub Inc.				
Mary S. Tyler. (1994). <i>Developmental Biology: A guide for experiment study:</i> Sinauer Associates Inc.				
Michael King. (2007). <i>Fisheries Biology, Assessment and Management:</i> Wiley-Blackwell.				
Pillay T. V. R.&Kutty M. N. (2005). <i>Aquaculture: Principles and Practices, (2nd ed.):</i> Wiley-Blackwell.				
Sambrook J., Fritsch, E.F., Maniatis, T. (1989). <i>Molecular cloning volumes-3:</i> Cold Spring Harbour Laboratory.				
Outcomes	On successful completion of this course, students should be able to acquire practical knowledge on the developmental biology, biotechnology techniques, identify the commercially important fishes. Familiar in the estimation of protein, carbohydrate, lipid and salt content in fishes. Able to estimate the survival and biomass in aquaculture farms.			

Name of the Course Teachers:

Developmental Biology

Ecology and
conservation biology

Evolution

Fishery Biology

Aquaculture

Dr.S.Subeena Begum

Dr.P.Kumar

Dr.P.Srinivasan

Dr.E.Kannapiran

Dr.N.M.Prabhu

III Semester					
Course code	509505	Major Elective 5		Credits:3	Hours: 3
		Research Methodology			
Objectives	<ul style="list-style-type: none"> ➤ To understand the essential components of research and its methodology. ➤ To identify an appropriate research problem and to solve them. 				
Unit -I	Laboratory practices and Spectral analysis: Good laboratory practices, Working principle of pH meter, Normality and Molarity calculation, Principles and its applications of UV-visible, Spectrofluorometer, Fourier Transform – Infrared spectrophotometer, flame photometer, Atomic Absorption spectrophotometers, Nuclear Magnetic Resonance, and Mass spectrophotometer.				
Unit-II	Histology and Microscopy: Principles and application of Histology and Histochemistry. Light Microscopy: Bright field, Phase contrast, Differential Interface Contrast Microscopy, Fluorescence Microscopy, Confocal Microscopy. Electron microscopy: Scanning and Transmission.				
Unit III	Chromatography and Molecular techniques: Principles and use of Centrifuges, Chromatography (Paper, thin-layer, and column), Electrophoresis, ELISA, PCR, RT-PCR, Blotting Techniques, Microarray techniques.				
Unit IV	Biostatistics: Sampling or census methods - random and non-random technique – Data collection. Description statistics of central tendency and dispersion – mean, median, mode, standard deviation, standard error. Probability distribution data - binominal, Poisson and normal distribution. Relational statistics of correlation and regression – Student's' test, ANOVA – one way and two-way analysis.				
Unit V	Manuscript Preparations: Literature collection - preparation of dissertation/thesis - preparation of scientific paper for publication in a Journal. Indexed, e-journals and citation metrics. Computer aided techniques for data analysis, data presentation and slide preparation.				
Reference and Text Books:-					
Bernard, A. R. (2006). <i>Fundamentals of Biostatistics</i> . Thomson-Brooks/Cole: Science.					
Chandler, D.E & Roberson, R.W. (2009). <i>Bioimaging: Current concepts in light and electron microscopy</i> . Sunbury, MA, USA: Jones & Bartlet Publishers.					
Gurumani, N. (2008). <i>Research Methodology for Biological Sciences</i> . Chennai: MJP Publishers.					
Gurumani, N. (2010). <i>An Introduction to Biostatistics</i> . Chennai: MJP Publishers.					
Hoppert, M. (2003). <i>Microscopic Techniques in biotechnology</i> : Wiley-Blackwell Publications.					
Sharma, A.K. (2005). <i>Textbook of Biostatistics II</i> : Discovery Publishing Pvt. Ltd.					
Veerakumari, L. (2006). <i>Bioinstrumentation</i> . Chennai: MJP Publishers.					
Outcomes:	Students can able to perform literature reviews using print and online databases and identify, explain, compare, and prepare the key elements of a research proposal/report. Gain knowledge on major knowledge on research instruments.				

Name of the Course Teachers: **Dr. P. Kumar**

III Semester				
Course code	509506	Major Elective-6 Entomology	Credits: 3	Hours: 3
Objectives	This elective paper has been designed to understand the biology of insects, insect pest management, Integrated Pest Management, and biological control.			
Unit -I	Classification of Insects- General characteristics of class Insecta and classification up to Order level – characteristics of each order with examples. Modern scheme of insect classification: Apterygota- Pterygota: Exopterygota (Hemimetabolous): Paleopteroid, Orthopteroid, Hemipteroid orders -Endopterygota (Holometabolous): Coleopteroid, Neuropteroid, Panorpoid and Hymnopteroid orders-Studies on the molecular evolutionary relationship between different groups of insects.			
Unit –II	Insect Physiology: - (Paddy & sugarcane insects)- Structure and physiology of integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive and nervous system.			
Unit-III	Agricultural Entomology Biology, nature, the extent of damage and control measures of insect pests of some important crops – paddy, sugarcane, cotton, groundnut, coconut, mango and beverages. Pests of stored products and their control, locusts and their control measures.			
Unit- IV	Pest Management: Biological control: parasites, predators and microbial agents. Chemical control: Pesticides- mode of action, Biopesticides: Integrated Pest Management (IPM) – definition, Integration of methods – potential components – the need for IPM and uses.			
Unit -V	Beneficial insects and Vector insects. Useful insects – Biology and control measures of important insect vectors – mosquitoes and houseflies.			
Reference and Text Books: - Awasthi, V.B. (2012). <i>Introduction to General and Applied Entomology</i> , (3 rd rev. ed.): Scientific Publishers Journals Dept. Chapman, R.F., Stephen J. Simpson, Angela E. & Douglas (Eds.) (2012). <i>The insects: Structure and Function</i> , (5 th ed.): Cambridge University Press. David, B.V. (2016). <i>Elements of Economic Entomology</i> , (8 th ed.): Brillion Publishing. Pruthi, H.S. (1969). <i>Textbook on Agricultural Entomology</i> . New Delhi: I.C.A.R. Publication. Saha, T. & Chandran, N. (2017). <i>Fundamentals of Entomology</i> : Write & Print Publications. Temphare, D.B. (1984). <i>A Text Book of Insect Morphology, Physiology and Endocrinology</i> . New Delhi: S.Chand and Co. Vasanthraj David, B. & Ramamurthy, V.V. (2012). <i>Elements of Economic Entomology</i> ,(7 th ed.).Chennai: Namrutha publications.				
Outcomes	By the end of the course, students should obtain knowledge to: identify the key pest insects of the major horticultural crops, understand the pest complexes of the agro-ecosystems; have a broad idea of chemical ecology and tritrophic interaction amongst host plants, pests and their natural enemies.			

Name of the Course Teacher: **Dr. M. Biruntha**

IV Semester			
Course code	509401	Animal Biotechnology	Credits: 5 Credits: 5
Objectives	<ul style="list-style-type: none"> ➤ To understand the principles and application of Biotechnology methods in animal. ➤ To understand recent techniques in Animal Biotechnology. 		
Unit -I	Introduction to Animal Biotechnology:- Definition - animal cell structure - macromolecules in the cell, concepts of genetic engineering, the scope of biotechnology, the principle of recombinant DNA technology, application of genetic engineering – GMO - transgenic animals- GEAC in India.		
Unit-II	Gene cloning:- Definition- steps- types of vectors used- Cloning in yeast <i>Saccharomyces cerevisiae</i> . <i>E. coli</i> vectors - pBR322 and its derivatives; Cloning vectors for Gram-negative bacteria – Lambda bacteriophage vectors, filamentous phages, Cosmids, Plasmids, Phagemids. Cloning in Gram-positive bacteria (<i>Bacillus subtilis</i>). Genetic engineering tools. Nucleic acid manipulating enzymes. Promoters, Selectable markers and reporters used in rDNA, technology. Restriction digestion, Ligation, Transformation, Selection of Recombinants. Construction of gene libraries.		
Unit III	Nucleic acid hybridization techniques; Molecular probes (Types of probes and its construction); probe labeling. Nick translation, End labeling and Random primer labeling. Polymerase chain reaction and its variants; DNA fingerprinting; DNA sequencing first generation sequencing methods (Maxam and Gilbert sequencing, Sanger's dideoxy sequencing, Pyrosequencing, PCR based sequencing and hybridization sequencing). Second generation sequencing methods. Site-directed mutagenesis; DNA microarray; chromosome walking and jumping. Molecular techniques in prenatal diagnosis gene therapy.		
Unit IV	Animal tissue culture: -History, animal cell culture media, cell type, cell growth kinetics, primary culture and subculture. Development of cell lines, types of culture methods - organ, histotypic, cell culture, stem cell culture, tissue engineering, scale-up - monolayer and suspension, Pharmaceutical products (Vaccine, Humulin, etc), valuable cell culture products - Insulin, tissue plasminogen activator, blood factors.		
Unit V	Embryo transfer & transgenic animal technology: - Artificial insemination in cattle, superovulation, embryo transfer, mating, splitting, cryopreservation, stem cell method, targeted gene transfer - knock in and knock out technology, transgenic mice, goat, cattle - gene pharming & other applications.		
Reference and Text Books: -			
Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K and Walter, P. (2007). <i>Molecular biology of the cell</i> . New York: Garland Publishing Inc.			
Beaker, W., Kleinsmith, L., Hardin, J & Bertoni, G. (2008). <i>The world of the cell</i> : Benjamin Cummings.			
Nagabhushanam, R., Diwan, A. D., Bernard J. Zahuranec & Sarojini R. (2004). <i>Biotechnology of Aquatic Animals</i> : Taylor and Francis.			
Portner, R. (2007). <i>Animal Cell Biotechnology: Methods and Protocols (Methods in Biotechnology)</i> : Humana Press.			
Renaville, R & Burny, A. (Eds.). (2001). <i>Biotechnology in Animal Husbandry (Focus on Biotechnology)</i> : Springer.			
Sasidhara, R. (2015). <i>Animal Biotechnology</i> : MJP Publications.			
Singh, B., Gautam, S.K. & Chauhan, M. S. (2012). <i>Textbook of animal biotechnology</i> : The Energy and Resources Institute, TERI.			
Outcomes	On successful completion of this course, students should be able to discuss the application of biotechnology in research and industry.		

Name of the Course Teacher: **Dr.V. Nithya**

II Semester				
Course code	509203	Non Major Electives-1	Credits: 2	Hours :3
Immunology				
Objectives	<ul style="list-style-type: none"> ➤ To understand the fundamental concepts of immunology and immunotechnology ➤ To provide in-depth ideas on innate and adaptive immunity mechanism and their response. 			
Unit -I	Introduction: History and scope of Immunology, Tissues and organs of the immune system - structure and function. Molecules of the immune system - antibodies, complements, cytokines, interferons - types, sources and functions. Antigen: classification, epitopes, antigen and antibody interaction.			
Unit-II	Innate and adaptive immunity: - Elements of the immune system: Hematopoiesis, T-cells, B-cells, myeloid cells, antigen presenting cells, a cell-mediated subset of T-Cells, helper and suppressor cells, cell-mediated and humoral immunity, antibody-dependent cell mediated cytotoxicity, natural killer cells.			
Unit III	Immune response: -Mechanism of humoral and cell-mediated immune responses - immunity to infections - immunoprophylaxis, vaccines and immunization schedule. Immunological disorders.			
Unit IV	Disease & Immune response: - Infectious diseases, hypersensitivity - Types I, II, III and IV; autoimmune disorder; immunodeficiency diseases. Tumour and transplantation immunology - Major histocompatibility complex (MHC), immunotherapy for the treatment of cancer.			
Unit V	Immune techniques: Immunocytochemistry, Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy.			
Reference and Text Books: -				
Blaine T. Smith. (2008). <i>Concepts in Immunology and Immunotherapeutics</i> , (4 th rev. ed.): American Society of Health-System Pharmacists.				
Chapel, H., Haeney, M., Misbah, S., & Snowden, N. (2014). <i>Essentials of Clinical Immunology</i> , (6 th ed.): Willey Blackwell Publishing.				
Kannan, I. (2013). <i>Immunology</i> : MJP Publication.				
Male, D., Brostoff, J., Roth, B, D. & Roit, I. (2006). <i>Immunology</i> , (7 th ed.): Elsevier.				
Owen, J., Jenni Punt, Sharon Stranford. (2013). <i>Kuby Immunology</i> , (7 th ed.): W. H. Freeman.				
Thomas J. Kind., Richard A. Goldsby., Barbara A. Osborne., Kubi, J. (2000). <i>Kuby Immunology</i> . New York: W.H. Freeman.				
Vaman Rao., (2016). <i>Immunology</i> . New Delhi: Narosa Publishing House Pvt, Ltd.				
Outcomes	The course will provide basic mechanisms, distinctions and functional interplay of innate and adaptive immunity.			

Name of the Course Teacher: **Dr. B.Vaseeharan**

II Semester				
Course code	509503	Non-Major Electives-2	Credits: 2	Credits: 3
		Food Processing Technology		
Objectives	➤ To explain the students with various operations of food processing			
Unit –I	Diary Processing –National and International status of diary processing- Pasteurization- freezing –refrigeration –Drying and dehydration and nutritional standards-Production cost analysis and marketing.			
Unit-II	Meat and Poultry processing –National and international status –Pre-processing –Processing and preservation –a different method of processing -nutritional standards –Production cost analysis and marketing.			
Unit III	Seafood Processing - National and international status –Pre-processing – Processing and preservation –a different method of processing -nutritional standards –Chilled fish processing -smoking-canning –drying –IQF -Nutritional standards -Production cost analysis and marketing.			
Unit IV	Fruits and Vegetable processing – Fruit & Vegetable –pre-processing – Processing and storage-nutritional standards			
Unit V	Food safety – History of food regulation –International and national standards-Food adulteration acts–Food quality assurance and control- sensory evaluations for various products, sanitary procedures –HACCP –GMP.			
Reference and Text Books: -				
Clark, S., Jung. & S., Lamsal, B. (Eds.). (2014). <i>Food processing principles applications, (2nd ed.)</i> : Wiley Publishers US.				
Fellows, P.J. (2000). <i>Food processing technology. Principles and practices, (3rd ed.)</i> . Woodhead Publishing: Elsevier.				
<i>Food safety and standards regulations</i> (2010). Ministry of health and family.				
John R. Campbell & Robert T. Marshall. (2016). <i>Dairy Production and Processing: The Science of Milk and Milk Products (1st ed.)</i> : Waveland Press.				
Pearson, A. M. (1994). <i>Quality attributes and their measurements in meat poultry</i> . Food Science & Nutrition: Springer.				
Richarson, R. I & Mead, C. (1999). <i>Poultry meat science, (1st ed.)</i> : CABI Publishing				
Walstra, P., Wouters, J.M. Jan, Geurts, J. T. (2005). <i>Dairy Science and technology</i> : CRC Press.				
Outcomes	Students who completed this course will understand food processing technology and its quality of meat, poultry, and seafood.			

Name of the Course Teacher: **Dr. N. M. Prabhu**

III Semester				
Course code	509304	Non-Major Electives-3 Fishery Biology & Aquaculture	Credits: 2	Hours:3
Objectives	<ul style="list-style-type: none"> ➤ To familiarize basic information about fishery biology, resources, management and basic skills to identify fish species ➤ To provide technical knowledge about recent aquaculture practices. 			
Unit –I	Fishery Biology: -Economically important marine and freshwater fishes about their fishery potential. Indigenous and modern craft and gears used for capture fisheries. Morphometric and meristic characters of fishes, food and feeding habits, age and growth, reproduction and spawning - Migration in fishes. -Fishery by-products.			
Unit-II	Fishery conservation: -Recent concepts in fisheries management - Endangered species management - Invasive species. <i>In situ</i> and <i>Ex-situ</i> conservation - Management of fisheries operations - Post-harvesting technology - Quality control – HACCP- Food safety.			
Unit III	Aquaculture: - Definition- Status of aquaculture in the world and India. Brood stock sourcing and collection methods - cultivable organisms - classification - various culture systems - a type of culture.			
Unit IV	Hatchery Management: -Type of hatchery, brood stock – induce breeding -larval production - feed management - water quality and disease management in cultivable species - Live feed production. Bio-security, SPF, HACCP, GMP systems in the hatchery.			
Unit V	Farm Management- Water quality, feed and disease management in freshwater and marine cultivable species, Biosecurity, HACCP, GMP and Biofloc technology - Integrated farming – Organic Farming.			
Reference and Text Books: -				
Agarwal, S.C. (2007). <i>A Handbook of fish farming, (2nd ed.)</i> : HB.				
Chakrabarty, (2010). <i>Biology, Breeding and Farming of Important Food Fish</i> : HB.				
Gopakumar, K. (2002). <i>Fish processing technology</i> , ICAR. New Delhi: Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research.				
Jean T. Nolan. (2009). <i>Offshore Marine Aquaculture</i> : Nova Science Pub Inc.				
Khanna & Singh. (2012). <i>A Text Book of Fish Biology and Fisheries</i> : Narendra Publication.				
Michael, K. (2007). <i>Fisheries Biology, Assessment and Management</i> : Blackwell Publishers.				
Pillay, T. V. R&Kutty, M. N. (2005). <i>Aquaculture: Principles and Practices, (2nd ed.)</i> : Wiley-Blackwell.				
Outcomes	On successful completion of this course, students should be able to discuss the fundamental concepts of fishery biology.			

Name of the Course Teachers: **Dr. E. Kannapiran&Dr. N. M. Prabhu**

CURRICULUM VITAE

Name : **Dr. B. Vaseeharan**
Designation : Professor and Head
Address : Department of Animal Health and Management
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Educational qualification:

- Ph.D (Zoology) - University of Madras, Chennai, India.
- M.Phil. (Zoology) - Scott Christian College, Manonmaniam Sundaranar University, Tirunelveli, India.
- M.Sc. (Zoology) - Scott Christian College, Manonmaniam Sundaranar University, Tirunelveli, India.
- B.Ed. (Biology and Education) - Madurai Kamaraj University, Madurai, India.
- B.Sc. (Zoology) - Sivandhi Adhithanar College, Madurai Kamaraj University, Madurai, India.

Professional experience:

- Professor & Head, Department of Animal Health and Management (from 2013 to till date)
- Associate Professor & Head, Department of Animal Health and Management (from 2008 to 2013)
- Teaching Experience – 13 Years
- Research Experience – 18 Years

Area of Research:

- Invertebrate Immunotherapy
- Nanopharmacology
- Biomaterials

Honours and Awards:

- 2018, Leading Educationalist of India Award, Friendship forum regarding “Economic Growth and National Unity” held at New Delhi on 25th September 2018.
- 2018, Bharat Excellence Award, Friendship forum regarding “Global brotherhood and peace” held at New Delhi on 25th September 2018.
- 2009, Young Scientist Award-SERC-FAST TRACK, Department of Science and Technology, New Delhi, India.
- 2004-07, Postdoctoral fellow award, in National Taiwan Ocean University, Taiwan by National Science Council- Taiwan.
- 2003-04, Postdoctoral fellow award, in National Tsing Hua University, Taiwan by National Science Council- Taiwan.
- 2001-03, Postdoctoral award by National Agriculture Technology Project (NATP), Indian Council of Agricultural Research (ICAR), New Delhi, India.

Recent publications:

- Protective activity of beta-1, 3-glucan binding protein against AAPH induced oxidative stress in *Saccharomyces cerevisiae*. **International Journal of Biological Macromolecules**
- Facile synthesis of haemocyanin-capped zinc oxide nanoparticles: Effect on growth performance, digestive-enzyme activity, and immune responses of *Penaeus semisulcatus*. **International Journal of Biological Macromolecules**
- Exposure of *Oreochromis niloticus* to sub-lethal copper concentrations: Effects on growth, antioxidant, non-enzymatic antioxidant, oxidative stress and non-specific immune responses. **Journal of Trace Elements in Medicine and Biology**
- Synthesis of ZnO nanoparticles using insulin-rich leaf extract: Anti-diabetic, antibiofilm and anti-oxidant properties. **Journal of Photochemistry & Photobiology, B: Biology**
- In vitro and in vivo toxicity assessment of selenium nanoparticles with significant larvicidal and bacteriostatic properties. **Materials Science & Engineering C**

Total Publications: 172, **Cumulative Impact factor:** 370, **Total Citation:** 3844, **h- index:** 34, **i10- index:** 92

CURRICULUM VITAE

Name : **Prof. Dato' Dr. Alieen Tan ShauHwai**
Designation : Director of Centre for Marine and Coastal Studies
Address : Universiti Sains Malaysia (USM)
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Educational qualification:

- Ph.D., in Marine Biology, Universiti Sains, Malaysia.
- Master of Science in Marine Biology, Universiti Sains, Malaysia
- Bachelor of Science in Microbiology, University kebangsaan, Malaysia, Sabah

Professional experience:

- Working Experience – 30 Years
- Research Experience – 27 Years

Area of Research:

- Expertise is in marine science, specializing in mariculture and conservation of molluscs.
- Focus on the biodiversity of marine invertebrates of Malaysian Seas and conducting research on the physiological responses of invertebrates, in particularly the responses of molluscs towards an acidic environment.

Honours and Awards:

- The first woman president of the 53-years old UNITAS Malacologica, which is based in Belgium, from 2013-2016

Recent publications:

- Evaluating Integrated Coastal Zone Management efforts in penang Malaysia
- Systematics, genetics, and biogeography of intertidal mites (Acari, Oribatida) from the Andaman Sea and Strait of Malacca
- Environment & Resource Management ERM-01 Presentation Type: Oral Coastal Zone Management in Penang, Malaysia: Governance, Challenges and Recommendations

Total Publications: 92, **Total Citation:** 598, **h- index:** 9, **i10- index:** 9

CURRICULUM VITAE

Name : **Prof. SITI AZIZAH MOHD. NOR**
Designation : Principal Research Fellow
Address : University Malaysia,
Terengganu
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Educational qualification:

- Ph.D., (University of Cardiff, Wales, UK)
- M. Sc., (University of Swansea, Wales, UK)
- B. Sc., (University of Newcastle-Upon Tyne, UK)

Professional Experience:

- Teaching Experience – 30 Years

Area of Research:

- Population genetics and phylogeography research, for conservation of wild and captive populations, mainly of important aquatic organisms.
- Identification of genetically optimal broodstock at the initiation of a breeding programme achieved through the utilisation of molecular markers

Honours and Awards:

- Member of the Asian Society of Ichthyologists since 2014 and Treasurer of ASEAN-Fisheries Education Network (ASEAN-FEN) from 2015
- Coordinator of the working committee for the preparation of the dossier to nominate Sungai Merbok, a mangrove biodiversity hotspot in north-west Peninsular Malaysia as a UNESCO Biosphere

Recent publications:

- Short-run and Long-run Relationship between Economic Growth, Foreign Direct Investment, Trade Liberalization and Education on Income Inequality: Evidence from Indonesia
- Deep genetic differentiation between two morphologically similar species of wolf herrings (Teleostei, Clupeoidei, Chirocentridae)
- DNA barcoding of shrimps from a mangrove biodiversity hotspot
- Effect of *Lactobacillus acidophilus* supplementation on growth performances, digestive enzyme activities and gut histomorphology of striped catfish (*Pangasianodon hypophthalmus* Sauvage, 1878) juveniles
- Influence of mannan oligosaccharide supplementation on haematological and immunological responses and disease resistance of striped catfish (*Pangasianodon hypophthalmus* Sauvage, 1878) juveniles

Total Publications: 227, **Total Citation:** 1559, **h- index:** 23, **i10- index:** 43

CURRICULUM VITAE

Name : **Dr. M. Ramesh**
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Educational qualification:

- Ph.D. - Zoology - Bharathiar University
- M.Phil. – Zoology - Bharathiar University
- M.Sc. – Special Zoology -University of Madras
- B.Sc. - Zoology - Madurai Kamaraj University

Professional experience:

- Research – 25 Year
- Teaching – 18 Years

Area of Research:

- Toxicology, Aquatic Toxicology, Fish Physiology and Biochemistry, Limnology, Aquaculture and Fisheries, Pharmacology and Toxicology, Ecobiotechnology, Environmental Impact Assessment.

Honours and Awards:

- University Research Fellowship from 01.04.1991 to 31.03.1993
- Council of Scientific and Industrial Research (CSIR, New Delhi) - Senior
- Research Fellowship from 18.01.1994 to 31.01.1997
- Council of Scientific and Industrial Research (CSIR, New Delhi) - Research
- Associate from 01.04.1997 to till date
- Research Board of Advisors - 1999
- Environmentalist of the year – 2003
- Beat paper award at International Conference in Zoology INCOZ 2006
- Visiting Fellowship to China
- UNU Fund to attend International Workshop at South Korea

Recent publications:

- Assessment of triclosan impact on enzymatic biomarkers in an Indian major carp, *Catlacatla*
- DNA damage and physiological responses in an Indian major carp *Labeorohita* exposed to an antimicrobial agent triclosan
- Chronic amoxicillin exposure affects *Labeorohita*: assessment of hematological, ionic compounds, biochemical, and enzymological activities
- Sulforaphane potentially attenuates arsenic-induced nephrotoxicity via the PI3K/Akt/Nrf2 pathway in albino Wistar rats
- Response of antioxidants to semisynthetic bacteriostatic antibiotic (erythromycin) concentrations: A study on freshwater fish

Total Publications: 97, **Total Citation:** 1855, **h- index:** 22, **i10- index:** 39

CURRICULUM VITAE

Name : **Dr. S. Janarthanam**
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Educational qualification:

- Bachelor of Science in Zoology, Government Arts College, Karur
- Master of Science in Zoology, Jamal Mohamed College, Thiruchirappalli
- M. Phil., in Zoology, Bharathiar University, Coimbatore
- Ph.D., in Entomology, Bharathidasan University, Thiruchirappalli.

Professional experience:

- Junior Research Fellow, School of Life Sciences, Bharathidasan University, Tiruchirappalli during Jan. 1991 – Feb. 1993 (2 years)
- Senior Research Fellow (CSIR, New Delhi), School of Life Sciences, Bharathidasan University, Tiruchirappalli during Mar. 1993 – Feb. 1996 (3 years)
- Research Scientist, Entomology Research Institute, Loyola College (Autonomous), Chennai – Mar. 1996 to May 2000 (4 years & 2 Months)
- Handled classes to students of “Diploma in Basic Biotechnology”, at Entomology Research Institute, Loyola College (Autonomous), Chennai from January 1998 May 2000.
- Senior Lecturer, P.G. & Research Department of Zoology, Thiagarajar College (Auto.), Madurai – 625 009 from 19 th June 2000 – 04 th March 2008 (7 years & 9 Months).
- Associate Professor, Department of Zoology, University of Madras, Guindy Campus, Chennai – 600 025, 05th March 2008 to till date.
- Teaching Experience: 20
- Research Experience: 25

Honours and Awards:

- Department of Science and Technology (DST), Government of India, Scheme for Young Scientists (SYS), 1998
- Department of Biotechnology (Government of India) Overseas Associate ship, Long term, 2000
- Department of Biotechnology (Government of India) Overseas Associate ship, Short term, 2006

Recent publications:

- Occurrence of natural lectin with bacterial agglutination property in the serum of lepidopteran pest, *Parasalepida*
- Antioxidant and GC-MS analysis of *Annona reticulata* leaves extract against unsecure free radicals
- β -Galactoside binding lectin from caddisfly larvae, *Stenopsychekodaikanalensis* with selective modes of antibacterial activity: Purification and characterization
- Population genetic structure and molecular diversity of *Leucinodesorbonalis* based on mitochondrial COI gene sequences
- Antiviral activity of selected medicinal plants and marine sea weeds on the grasserie infected larvae of silkworm, *Bombyx mori*

Total Publications: 132, Total Citation: 528, h- index: 10, i10- index: 11

CURRICULUM VITAE

Name : **Dr. V. Ganesan**
Designation : Technical Director
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Educational qualification:

- Ph.D., Centre for Advanced Studies in Botany, University of Madras, Chennai
- M.Sc., KandasamyKandar's College- Velur
- B.Sc., KandasamyKandar's College- Velur

Professional experience:

- Technical director, Technical Advisor to R&D, Skill Development (2018 to present)
- Director, Technical Advisor to R&D (2015-2018)
- Managing Director, Overall Administration and Head R&D, Preparation of Teaching Kits & Molecular Biology Reagents (2008-2015)

Area of Research:

- Molecular Biology

Dr.V.Ganesan, The Managing Director of Acme ProGen is a doctorate in Molecular Biology from University of Madras. He has published six international publications and two book chapters.

About the company

Acme ProGen Biotech is a Private Limited company founded in 2007.

The ProGen Biotech is located in Salem, a city in the North-west of Tamil Nadu, India. Acme ProGen is developing and commercializing all kinds of ready-to-use biological teaching and research kits that simplifies and improves the quality research in the life science field. In addition, ProGen supplies instruments/equipments to support life sciences researches. A series of complementary products manufactured by our company and others companies round off the product range. ProGen distributes a highest quality product of biochemicals which are useful to life science researchers in life sciences.

CURRICULUM VITAE

Name : **Dr. E. Kannapiran**
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Educational qualification:

- Ph.D., Marine Biology and Oceanography (Annamalai University)
- M. Phil., Marine Biology and Oceanography (Annamalai University)
- M.Sc., Marine Biology and Oceanography (Annamalai University)
- B.Sc., Zoology (Madurai Kamaraj University)

Professional experience:

- Professor of Zoology, Directorate of Distance Education, Alagappa University, 13.08.2014 onwards
- Associate Professor in Zoology, Directorate of Distance Education, Alagappa University, 13.08.2008 – 12.08.2014
- Lecturer- Oceanography and Coastal Area Studies, Alagappa University, 16.08.1999-11.08.2008
- Lecturer (Adhoc), Oceanography and Coastal Area Studies, Alagappa University, 28.12. 1998 – 15.08.1999
- Teaching Experience: 21 years
- Research Experience: 20 years

Area of Research:

- Marine Biology: Marine Microbiology, Coral Reef and Marine Fouling

Additional Responsibilities:

- Dean, i/c College Development Council, Alagappa University from 04.03.2019 Onwards
- Director, Curriculum Design and Development Cell, Alagappa University from 25.07.2018 Onwards
- Co-Ordinator (PCP) Alagappa University from 28.10.2013 Onwards
- Member of Project Monitoring Unit RUSA committee on Academic Affairs from 2019 Onwards
- Ex-officio Member of Broad based board of studies in the process of redesigning the curriculum of all programmes offered in Alagappa University.

Recent publications:

- Screening, partial purification of antivibriosis metabolite sterol-glycosides from *Rhodococcus sp.* against aquaculture associated pathogens– **Microbial Pathogenesis**
- New geographical record of the moray eel *Gymnothoraxreticularis*, bloch, 1795 (Anguilliformes: Muraenidae) with Taxonomic status and Distribution from Southwest coast of India – **Thalassas: An International Journal of Marine Sciences.**
- Record of “Near Threatened “crocodile shark *Pseudocarchariaskamoharai* (Pseudocarchariidae) from Indian Exclusive Economic Zone –**Thalassas: An International Journal of Marine Sciences.**
- Invitrobiomedicinal properties of Pyrrolidine-2,4- Dione derived from a novel actinobacterium *Streptomyces rochei*, a green approach – **Biocatalysis and Agricultural Biotechnology**
- Biogenic synthesis of gold nanoparticles from *Halymeniadilatata* for pharmaceutical applications: Antioxidant, anti-cancer and antibacterial activities – **Process Biochemistry**

Total Publications:51, Cumulative Impact factor: 52, Total Citation: 431, h- index: 12, i10- index: 14

CURRICULUM VITAE

Name : **Dr. P. Srinivasan**
Designation : Associate Professor
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Educational qualification:

- Ph. D. (Zoology-Biotechnology Interdisciplinary), Dept. of Biotechnology, University of Madras, India (2006)
- M. Sc. Zoology, Jamal Mohamed College, Bharathidasan University, India (1997)
- B. Sc. Zoology, A.V.V.M. Sri Pushpam College, Bharathidasan University (1995)

Professional experience:

- Associate Professor, Department of Animal Health & Management, Alagappa University, Karaikudi - 630 003 (31.08.2015 to till date)
- Assistant Professor, Department of Bioinformatics Alagappa University, Karaikudi - 630 003 (26.05.08 to 30.08.2015)
- Teaching Experience: 12 Years

Area of Research:

- Aquaculture Biotechnology
- Phage therapy for *Vibrio* spp control in Aquaculture
- Cancer biology.

Honours and Awards:

- Tamil Nadu Junior Research Fellow by Government of Tamil Nadu
- Teaching cum Research Fellow by Department of Biotechnology, University of Madras.
- Post Doctoral Research Fellowship, Department of Genetics, Mohida University, Thailand.
- DST-Fast Track Young Scientist Award by Dept of Science & Technology, New Delhi
- National Young Leaders Programme Award by Ministry of Youth Affairs & Sports, New Delhi
- ALU Best NSS Programme Officer Award by Alagappa University, Karaikudi.

Recent publications:

- Efficacy of potential phage cocktails against *Vibrio harveyi* and closely related *Vibrio* species isolated from shrimp aquaculture environment in the south east coast of India. **Veterinary Microbiology.**
- Morphological characterization and biocontrol effects of *Vibrio vulnificus* phages against *Vibriosis* in the shrimp aquaculture environment. **Microbial Pathogenesis.**
- Green synthesis of silver nanoparticles using *Lippianodiflora* aerial extract and evaluation of their antioxidant, antibacterial and cytotoxic effects. **Resource-Efficient Technologies.**
- Theoretical, biological and in silico studies of pendant-armed heteroleptic copper (II) phenolate complexes. **Journal of Molecular Structure.**
- Antiproliferative and apoptosis-induction studies of 5-hydroxy 3', 4',7-trimethoxyflavone in human breast cancer cells MCF-7: an in vitro and in silico approach. **Journal of Receptors and Signal Transduction.**

Total Publications: 102, **Cumulative Impact factor:** 101, **Total Citation:** 704, **h- index:** 15, **i10- index:** 26

CURRICULUM VITAE

Name : **Dr. N. M. Prabhu**
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Educational qualification:

- Ph.D., Marine Biology ,CAS in Marine Biology, Annamalai University
- M.Sc., Coastal Aquaculture ,CAS in Marine Biology, Annamalai University
- B.Sc., Zoology (Thiagarajar College, MKU, Madurai)

Professional experience:

- Assistant Professor, Department of Animal Health and Management, Alagappa University, from 2008 to till date.
- Production Manager, The Handy Water base (Pvt)-2005 to 2008
- Assistant Manager, The Water base Ltd, 1999 to 2005
- Teaching Experience – 11+ Years
- Research Experience – 17 Years

Area of Research:

- Isolation of bioactive compounds herbal plants and marine seaweeds for anticancer properties.
- Isolation of therapeutic potential sulfated polysaccharides from seaweeds.
- Control and prevention of bacterial pathogens using plant compounds, probiotics and nanoparticles

Honours and Awards:

- 2006 to 2008, Approved Sea food technologist
- 2003 to 2005, Found a new method of brood collection to reduce the virulence of virus like WSSV, MBV, YHV worked in collaborated project (Water base India Ltd tie up with INVA and Monotech, USA).
- 2000 to 2003 standardized the Soft Shell Mud Crab production for commercialization and exported to Handy International, USA.
- 1999 to 2000, Found a new method for culturing the Soft Shell Mud crab first people in India – The Water base India Ltd
- 1995 to 1997, Project fellow – Shrimp spawner development for Hatchery purposes approved by Tamilnadu state council for science and technology.
- 1994, Project fellow - M/S Sriram Marine Harvest Ltd, Poompuhar (400 ha includes, Hatchery, Farm)

Recent publications:

- Antibacterial efficacy of a fucoidan fraction (Fu-F2) extracted from *Sargassumpolycystum*– **International Journal of Biological Macromolecules**
- Synthesis, characterization, anti-proliferative and wound healing activities of silver nanoparticles synthesized from *Caulerppascalpelliformis*– **Process Biochemistry**
- Studies on structural properties and immune-enhancing activities of glycomannans from *Schizophyllum commune*– **Carbohydrate Polymers**
- Structural characterization of a polysaccharide from *Certariaislandica* and assessment of immunostimulatory activity – **Process Biochemistry**
- Ecofriendly one pot fabrication of methyl gallate @ ZIF-L nanoscale hybrid as pH responsive drug delivery system for lung cancer therapy– **Process Biochemistry**
- Biogenic synthesis of gold nanoparticles from *Halymeniadilatata* for pharmaceutical applications: Antioxidant, anti-cancer and antibacterial activities – **Process Biochemistry**

Total Publications: 52, Cumulative Impact factor: 97, Total Citation: 699, h- index: 15, i10- index: 19

CURRICULUM VITAE

Name : **Dr. M. Biruntha**
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Educational qualification:

- Ph.D -Zoology
- M.Phil –Zoology
- M.Sc–Zoology
- M.Ed–Education
- B.Sc-Zoology

Professional experience:

- 1st August 2008 to 25th January 2016 –Assistant Professor, Dept of Biological Science, Mother Teresa College of Education, Illuppur, Pudukkottai.
- 30th January 2016 to till date, Assistant Professor, Dept. of Animal Health and Management, Alagappa University.
- Teaching Experience : 11+
- Research Experience : 4

Area of Research:

- Vermitechnology

Honours and Awards:

- Dr.S.Radhakrishnan Teacher's Welfare Association
- Council for Teacher Education, Tamil Nadu State centre
- Indian Academic Researchers Association
- Tamilnadu Scientific Research Organization

Recent publications:

- Methylation-dependent circulating microRNA 510 in preeclampsia patients -**Hypertension Research.**
- MicroRNA21 and the various types of myeloid leukemia- **Cancer Gene Therapy**
- Dissecting the role of miR-21 in different types of stroke-**Gene**
- Dissecting the functional role of microRNA 21 in osteosarcoma- **Cancer Gene Therapy**
- Methylation dependent microRNA 1285-5p and sterol carrier proteins 2 in type 2 diabetes mellitus Artificial Cells -**Nanomedicine, and Biotechnology**

Total Publications: 21, Cumulative Impact factor: 18, Total Citation: 18, h- index: 3, i10- index: -

CURRICULUM VITAE

Name : **Dr. V. Nithya**
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Educational qualification:

- **B.Sc., Biochemistry**, Shrimati Indira Gandhi College, Bharathidasan University.
- **M.Sc., Biochemistry**, Shrimati Indira Gandhi College, Bharathidasan University.
- **PGDBI, Bioinformatics**, Shrimati Indira Gandhi College, Bharathidasan University.
- **M.Phil, Biochemistry**, Bharathidasan University.
- **M.Sc., Bioinformatics**, Bharathiar University.
- **M.Sc., Biotechnology**, Periyar University.
- **Ph.D., Biotechnology**, Bharathidasan University.
- **M.B.A., Information System Management**, Bharathiar University.
- **D.Sc, Biotechnology (pursuing)** Madurai Kamaraj University.

Professional experience:

- Assistant Professor in Department of Animal Health and Management, Alagappa University, Karaikudi, from 30/01/2016 to Till date.
- Assistant Professor in Department of Microbiology, UrumuDhanalakshmi College (Autonomous), Trichy, from 01/07/2013 to 29/01/2016.
- Assistant Professor in Department of Biotechnology, SrimadAndavan Arts and Science College, Trichy, from 30/05/2007 to 30/06/2012
- Teaching Experience: 10 Years

Area of Research:

- Pharmacognosy

Honours and Awards:

- Outstanding Alumnus Award, 2018 in Shrimati Indira Gandhi College, Bharathidasan University.
- Member of Syndicate in Bharathidasan University has been nominated by Hon'ble Chancellor, Governor of Tamil Nadu from 19/07/2018.

Recent publications:

- Hepatoprotective effect of silver nanoparticles synthesized using aqueous leaf extract of *Rhizophoraaapiculata*. **International Journal of Nanomedicine**.
- Bioactive compound analysis of *Coriandrum Sativum* L. against microbial keratitis,"Ophthalmology: **Breakthroughs in Research and Practice: & IGI Global Book Submission System**.
- *In silico* Structural Analysis of 16S rDNA Sequences of Bacteria Isolated from Keratitis Patients. **Trends in Bioinformatics**
- Efficacy of anti-diarrheal activity of *Pedaliium murex* L., in wistar albino rats. **BMC Infectious Diseases**.
- Evaluation of the wound-healing activity of *Hibiscus rosasinensis* L (Malvaceae) in Wistar albino rats. **Indian journal of pharmacology**.

Total Publications: 35, Cumulative Impact factor: 11.68, Total Citation: 164, h- index: 5, i10- index: 5

CURRICULUM VITAE

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Educational qualification:

- B.Sc., Botany Spl. Industrial Microbiology, The American College
- M.Sc., Sub-Aqua Marine Ecology and Toxicogenomics, Madurai Kamaraj University
- Ph.D., Environmental Biotechnology, Bharathidasan University

Professional experience:

- Junior Research Fellow, Bharathidasan University (10.12.2010 – 09.12.2012)
- Senior Research Fellow, Bharathidasan University (10.12.2012 – 30.06.2014)
- Assistant Professor, Alagappa University (31.01.2016 – Till Date)
- Teaching experience: 4
- Research experience: 4

Area of Research:

- Molecular Cancer biology.

Honours and Awards:

- Outstanding researcher award, Saveetha Dental College, 2019
- Early Career Research Award by Science and Engineering Research Board, New Delhi, 2016
- Cover Page article – Inorganic Frontiers and Chemistry, 2014 – DOI: 10.1039/C4QI00018H.
- Awarded Junior Research & Senior Research Fellowship by DST-NRDMS (2010 – 2014).

Recent publications:

- Phloroglucinol-conjugated gold nanoparticles targeting mitochondrial membrane potential of human cervical (HeLa) cancer cell lines. **Spectrochimica Acta A Molecular and Biomolecular Spectroscopy.**
- A perspective on biogenic synthesis of platinum nanoparticles and their biomedical applications. **Spectrochimica Acta A Molecular and Biomolecular Spectroscopy.**
- Cytotoxicity of phloroglucinol engineered silver (Ag) nanoparticles against MCF-7 breast cancer cell lines – **Materials Chemistry and Physics.**
- Coumarin-gold nanoparticle bioconjugates: preparation, antioxidant, and cytotoxic effects against MCF-7 breast cancer cells” **Applied Nanoscience.**
- Gold nanoparticles tethered cinnamic acid: Preparation, Characterization and cytotoxic effects on MCF-7 breast cancer cell lines-**Applied Nanoscience.**
- Proteomics analysis of crude squid ink isolated from *Sepia esculenta* for their antimicrobial, antibiofilm and cytotoxic properties-**Microbial Pathogenesis.**

Total Publications: 30, Cumulative Impact factor: 59, Total Citation: 517, h- index: 10, i10- index: 10

CURRICULUM VITAE

Name : **Dr.S.Subeena begum**
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Educational qualification:

- M.Sc., Zoology (Madurai Kamaraj University, Madurai)
- M.Phil., Zoology (Madurai Kamaraj University, Madurai)
- Ph.D., Zoology (Madurai Kamaraj University, Madurai)

Professional experience:

- Teaching Experience – 17 Years
- Research Experience – 9 Years

Area of Research:

- Herbal based immunology,
- Nonspecific immune response and specific immune response.

Recent publications:

- Synergistic effect of medicinal plant leaf extracts supplemented diet on non-specific immune responses in fresh water fish *Channa striatus* – **International Journal of Zoology Studies**
- Dietary supplement of mixture of medicinal plant leaf extracts on immune response of fresh water fish *Mystus keletius* – **International journal of advanced research**
- Studies on the immunostimulatory effect of extract of *Solanum trilobatum* and *Ocimum sanctum* in *Mystus keletius* – **International Journal of fishery Aquaculture**
- Synergistic effect of plant extracts supplemented diets on immunity and resistance to *Aeromonas hydrophila* in *Mystus keletius* - **Journal of Pharmacy and Biological Sciences**

Total Publications: 5, Cumulative Impact factor: 12, Total Citation: 13, h- index: 2, i10- index: -

**CURRICULUM VITAE
ALUMINI**

Name : **Dr. K. Devi**
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Address : Department of Physiology
Eastern Virginia School of Medicine
Virginia
Email : kdevinfmc@gmail.com



Educational qualification:

- Bachelor of Science in Biotechnology from Dhanalakshmi Srinivasan College of Arts and Science, Perambalur, affiliated to Bharathidasan University, Tiruchirappalli
- Master of Science in Marine Biotechnology from Bharathidasan University, Tiruchirappalli
- Doctor of Philosophy in Animal Health and Management from Alagappa University, Karaikudi.

Professional experience:

- Research Experience – 9 Years
- Ph.D project entitled “Mitochondrial genome analysis of type 2 diabetes and associated peripheral neuropathy complication” under the guidance of Dr.N.M.Prabhu, Alagappa University, Karaikudi.
- M.Sc., Dissertation entitled “Molecular study of Indu-Malayali tribe population by using Mitochondrial DNA and Y-Chromosome marker under the guidance of Dr.K.Thangaraj, Centre for Cellular and Molecular Biology (CCMB), Hyderabad

Experience in genetic and phylogenetic techniques

- Sequence alignments
- Phylogenetic tree construction
- Relatedness and common ancestor prediction

Area of Research:

- Diabetology
- Molecular Biology
- Molecular Genetics

Recent publications:

- Mitochondrial ND1 gene mutation analysis in type II diabetes of Karaikudi population
- The prevalence, awareness and potential of complementary alternative medicine in type 2 diabetics living in Madurai, India
- Ameliorative effect of ferulic acid against renal injuries mediated by nuclear factor-kappaB during glycerol-induced nephrotoxicity in Wistar rats
- Type 2 diabetic neuropathy with special reference to mitochondrial role and its effective management
- Awareness on Type II Diabetes and Its Complication among Sivaganga District Population in Tamilnadu: A Cross Section Survey.

Total Publications: 7, Total Citation: 35, h- index: 3, i10- index: 1