

ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A' Grade by NAAC)

Thoothukudi-628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)



Syllabus (w.e.f. 2018)

M.Phil Zoology

Preamble

M.Phil programme enhances students to take up emerging fields in zoology like Research Methodology, Nanotechnology, Marine Biology, Aquaculture, Toxicology etc. Students are provided with opportunities to acquire skills to take up research, teaching, entrepreneurship and other employment opportunities in zoology

Programme Outcomes:

PO No	Upon completion of of M.Phil., degree programme, the scholars will be able to
PO 1	Develop critical understanding at an advanced level of up-to date knowledge and Research Methodology of a particular field .
PO 2	Implement effective academic and personal strategies for carrying out research projects independently and ethically.
PO 3	Contribute original Knowledge in response to issues in the areas of Zoology
PO 4	Communicate and disseminate research findings effectively in the academic community and to stakeholders in the society
PO 5	Evaluate ones own research in relation to important and latest issues in Zoology
PO 6	Engage in intellectual exchange with researchers from other disciplines.
PO 7	Identify and define emerging problems and of innovative and original solutions to the problems in novel situations.
PO 8	Acquire flexibility to accommodate new knowledge and perspectives.

Course Structure (w.e.f. 2018 – 2019)

Semester –I

Component	Sub. Code	Title of the Paper	No. of hours				Credit	Max.Marks		
			Theory	Library	Seminar	Total		CIA	ESE	Total
Core I	18MLZC11	Research Methodology	4	4	2	10	4	50	50	100
Core II	18MLZC12	Advances in Animal Biotechnology & Nanotechnology	4	4	2	10	4	50	50	100
Project Oriented Elective (Any one of the papers can be chosen by the candidates)	18MLZE11 /12 /13	Aquaculture Systems and Management/ Marine Biology / Environmental Toxicology	4	4	2	10	4	50	50	100
		Total				30	12			

Semester –II

Component	Sub. Code	Title	No of Hours			Max.Marks				
			Laboratory	Library	Total	Credits	Dissertation		Viva Voce	Total
							Int.	Ext.		
Project	18MLZP21		15	15	30	12	50	25	25	100

Programme Specific Outcomes :

PSO No	Upon completion of of M. Phil., Zoology programme, the students will be able to
PSO-1	Maintain the highest standards of personal and academic integrity.
PSO-2	Demonstrate a broad understanding of the central facts and the experimental basis of modern Zoology
PSO-3	Reach a high level of achievement in writing research or project activities, problem solving and communications.
PSO-4	Critically, synthesize and evaluate knowledge across broad range of zoology.
PSO-5	Gain a comprehensive understanding of techniques and a thorough knowledge applicable to their own field.
PSO-6	Analyze critically with an aptitude for continued self- directed learning.
PSO-7	Design and carryout a research project.
PSO-8	Contribute to the advancement of knowledge in the Zoology

SEMESTER – I			
Core I : Research Methodology			
Code : 18MLZCII	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Vision:

To understand the concepts of research and it's methodologies

Mission:

To equip the students with the knowledge and the process of research and it's approaches, the research techniques, data analysis and dissemination of research.

Course Outcomes :

CO.No	Upon completion of this course, students will be able to	PSO's addressed	CL
CO-1	Be familiar with the types of databases often searched, the ways of organizing materials found and the techniques of preparation of research reports and proposals	3	Kn
CO-2	Understand research management, regulations, supervisors role, research ethics and the reliability and validity of educational research	1	Un
CO-3	Perform statistical tests of a hypothesis, data collection, analysis and interpretation of the research process	3	Ap
CO-4	Apply a range of quantitative and qualitative research techniques to the issues	5	Ap
CO-5	Analyse and identify the various types of sampling and steps involved in selecting a good instrument to use in the study	2	An
CO-6	Develop skills in handling the instruments and biotechniques	5	Ap
CO-7	Recognize the different methodologies to be adopted for conducting research in more appropriate manner	7	An
CO-8	Gain knowledge on the software packages available, skills to evaluate different research approaches and conceptualise the research process	8	Kn

SEMESTER – I			
Core I : Research Methodology			
Code : 18MLZCII	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Unit I Research Documentation : Literature collection, online, internet and worldwide web searching tools, e-journals and e-books., Abstract services, Information storage and retrieval, Manuscript processing: citation and proof correction, thesis and journal format, preparation and submission of a research paper– Impact factor – Citation index, Plagiarism

Unit II Statistical Methods and application : Experimental designs – Test of Significance – Student’s t-test, Chi-square test, F-test – Analysis of Variance - One way, two way analysis – Correlation coefficients – Single and Multiple Correlation – Simple and Multiple Regressions Statistical software- SPSS

Unit III Electron Microscopy: SEM, TEM, STEM – Principles and applications – histological preparations of tissues for SEM & TEM
Chromosome banding techniques (G – C – Q – R banding)
Principles and applications-High performance liquid chromatography (HPLC), GC-MS, NMR & Atomic Absorption Spectrophotometer.

Unit IV Electrophoresis : Principle and applications of PAGE and SDS – PAGE - Gel Documentation – 2-D Electrophoresis -
Immunological Techniques : Antigen – Antibody preparation and Purification - Immunofluorescence, Flow Cytometry, FISH and GISH

Unit V Diversity indices -using of softwares for calculating biodiversity
Tracer techniques: Autoradiography and its applications – Radiation measuring devices. – Geiger Muller counter and Scintillation counter – principles and applications.

Books for Reference :

1. Rana, S.V.S. 2005. *Biotechniques – Theory and Practice*, Rastogi Publishers, Meerut, India.
2. Veerakumari, L. 2006. *Bioinstrumentation*, M.J.P. Publishers, Chennai.
3. Das, H.K. 2005. *Text Book of Biotechnology (2nd Edition)*, Wiley Dreamtech India Pvt Ltd.
4. Keith Wilson and John Walker, 2010. *Principles and Techniques of Biochemistry and Molecular Biology*. Cambridge University Press.
5. Gurumani N. 2010. *Scientific Thesis Writing and Paper Presentation*. MJP Publishers, Chennai.
6. Gurumani N. 2011. *Research Methodology for Biological Sciences*. M.J.P. Publishers, Chennai.
7. RabinrdaNarain ,2012. *Practical Immunology*. Wisdom Press New Delhi
8. Gautham, N, 2006 *Bioinformatics, Databases and Algorithms* , Narosa Publishing House, Pvt. Ltd. New Delhi

SEMESTER – I			
Core II :Advances in Animal Biotechnology and Nanotechnology			
Code : 18MLZCI2	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Vision:

To acquaint the students with the multitude of potentials for advances in Animal Biotechnology and Nanotechnology.

Mission:

To impart the basic concepts, methodology, tools, techniques and solutions related to multidisciplinary field of Biotechnology and Nanotechnology

Course outcomes :

Co. No	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Display a broad understanding of biotechnology manipulation	5	Kn
CO-2	Assimilate concepts and methodologies in academic, industrial and research environment.	1,2	Kn, An
CO-3	Develop an understanding of problems of Biotechnology and an attitude to continuously adapt in a knowledge based society	1	Un,An
CO-4	Competent in applying the quantitative analytical skills in research science and clinical health	5	Ev,An
CO-5	Appreciate the need and impact biotechnological solutions keeping in new need for sustainable solution	6	Ev,An
CO-6	Elucidate the emerging needs in Nanotechnology	4	An
CO-7	Apply knowledge from various domains in a creative expansion, deepening and integrating in research	7	Ap
CO-8	Justify societal health, safety and legal issues of Biotechnology and Nanotechnology	8	Cr

SEMESTER – I			
Core II :Advances in Animal Biotechnology and Nanotechnology			
Code : 18MLZCI2	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Unit I Recombinant DNA technology- Tools and methodology cloning vehicles - plasmid - phage- BAC -YAC - cosmid- importance of tissue culture in biomedical and biochemical research- Pharmaceutical proteins (blood products and hormones) -Production of human and animal vaccines - Disease diagnostic kits.

Unit II Methods of mapping and sequencing of genome- Human Genome Project – benefits - ethical, legal and social issues –Genetically engineered animals - animal biotechnology and bioethics.

Unit III Applications of biotechnology and genetic engineering- genomics and proteomics - DNA fingerprinting - uses in diagnostic and forensics - gene therapy strategies - DNA bar coding of animals.

Unit IV Nanotechnology - introduction to Nanoworld - Classification of nano materials - nanocrystals and their applications -nanofactories -nanobiosensors - optical biosensors - DNA biosensors - Quantum dots - application in biotechnology.

Unit V Nanotechnology in biomedical applications - nanomedicines and drug delivery systems- health and environment impacts of nanotechnology - pros and cons of nanotechnology

Books for Reference :

1. Balasubramanian, D., C.F.A Bryce, K. Dharmalingam, J. Green and KunthalaJayaraman 2005. University Press (India) Private limited.
2. SubbiahBalaji 2010 *Nanobiotechnology*, MJP Publishers, Chennai
3. Ignacimuthu S. 2015 *Biotechnology An Introduction* , Reprint 2015,Narosa Publishing House Pvt Ltd. New Delhi
4. Murthy B.S., Shankar P. and James Murday2012 . *Text book of Nanoscience and Nanotechnology*. Universities Press (India) Private Limited , Hyderabad.
5. Niemeyer, C.M., C.A. Mirkin 2004. *Nano Biotechnology:Concepts Applications and Prespectives*, Wiley – VCH, ISBN: 3527306587.
6. Ratledge, C. and B. Kristiansen, *Basic Biotechnology*, Cambridge University Press.
7. Singh, B.D., 2003. *Biotechnology*, Kalyani Publications, Chennai.
8. Sree Krishna, V. *Bioethics and Biosafety in Biotechnology*, New Age International Publishers., New Delhi.
9. Willner, E. Katz 2005. *Bioelectronics: From Therapy to Applications*, (eds)Wiley – VCH Verlag GmbH & Co. KGaA, ISBN: 352730690.

SEMESTER – I			
Elective I: Aquaculture Systems and Management			
Code : 18MLZE11	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Vision

To familiarize and perceive the importance of aquaculture potentials and to understand the various techniques of production of food fishes.

Mission

To acquaint with the techniques of aquaculture and production to create an avenue for self employment

Course outcomes :

Co. No	Upon completion of this course, students will be able to	PSOs addressed	C L
CO-1	Understand the importance and potential of aquaculture in development of the Nation	1,2,8	Un
CO-2	Evaluate different kinds of culture practices and analyze the ethical and societal consequences of the production of aquatic organisms	4	Ev, An
CO-3	Understand the physical and chemical factors and how they can be manipulated in culture ponds	2, 5	Un
CO-4	Design aquaculture systems, solve engineering issues in aquaculture and employ scientific techniques to improve aquatic resource management	3	Cr
CO-5	Develop the design criteria for tanks, cages, raceways and pen culture systems	3, 4, 7	Cr
CO-6	Identify the techniques involved in breeding, seed production, and transport of seed and brood fish.	5	Ap
CO-7	Outline the basic culture methodologies of shrimp, food fish and ornamental fish in ponds	5	Un
CO-8	Evaluate the principles of genetic improvement of fish stock and cryopreservation of gametes	8	Ev

SEMESTER – I			
Elective I: Aquaculture Systems and Management			
Code : 18MLZE11	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

Unit I Present status and recent trends in world aquaculture - role and potential of aquaculture in national development, characteristics of cultivable species: shell fish, fin fish (fresh water, brackish water and marine fish species) - aquaculture practices – management of culture ponds - maintenance of water quality.

Unit II Aquaculture Engineering: Site suitability and water resources for aquaculture practices - properties of soil - layout designs - selection of equipment and materials - design and construction of fish hatcheries - grow out ponds and related structures - designs of cages, pens and rafts - use of filters and treatment systems in aquaculture - water pumping systems - aeration

Unit III Seed production: Brood stock management - domestication of brood stock - seed quality - methods of controlled spawning - hormonal induction and artificial fertilization - larval rearing - techniques used in packing seeds and brood stock for transport.

Unit IV Grow out systems: Culture of fin fish and shrimp in earthen ponds - ornamental fish culture in tanks and ponds - culture of fin fish in cages and pens - integrated fish farming practices - fish farming in recirculation systems - techniques used in packing live fish.

Unit V Genetic Improvement of stock: selective breeding, hybridization, transgenic fishes – Chromosomal manipulation: gynogenesis, androgenesis, production of monosex and sterile fishes, cryopreservation of gametes.

Books for Reference

1. Jhingram, U.G 1997, *Fish and Fisheries of India*. Hindustan Publishing New Delhi
2. Dubey S.K. and Bandand Ghosh 2012. *Fisheries and Economics*. Daya Publishing House, New Delhi.
3. Karimark .K and Sundararaj .V. Tamvasu, 1996. *Manual on Fish Genetics*, Chennai.
4. Santhanam .R, Sukumaran.N and Natarajan 1990. *A Manual of Fresh Water Aquaculture*. Oxford and IBH Publishing Co.Pvt.Ltd.New Delhi.
5. Agnihotri S.B.2013 *Aquaculture Management and Technology*. Swastik Publication, Delhi.
6. Felix.S 2010. *Marine and Aquaculture Biotechnology* . Published by Agrobios, Jodhpur, India.
7. Pandian I.D, Abhinandan Kumar and Rajbhusan Prasad 2009. *Aquaculture and Biotechnology*. A.K Publishers. New Delhi.
8. Haniffa M.A. 2011. *Aquatic Resources and Aquaculture*, Dominant Publishers, Delhi.
9. Shagufta, 2012. *Fisheries Aquaculture and Biotechnology*. APH Publishing Corporation Delhi.
10. Ahmed Singh S.H and A.K.Singh 2011, *Fresh Water Aquaculture*, Daya Publishing House, Delhi.
11. Jai Shankar Ojha 2006. *Aquaculture Nutrition and Biochemistry*, Agrotech Publishing Academy, Udaipur.
12. Ghosh P.K ,2010. *Brackish Water Aquaculture*, Agrobios Publications , Jodhpur.
13. Rajendrakumar Rath, 2011, *Fresh Water Aquaculture* , Scientific Publishers, Jodhpur.

Semester I			
Elective II : Marine Biology			
Code: 18MLZE12	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

Vision :

Provide quality education and training in marine biological sciences. Conduct qualitative researches in the marine biological sciences. Establish a national and international cooperation in the field of educational research. Develop public awareness materials, and train personnel in the field of marine biology.

Mission :

Provide quality output in terms of education and training in the field of marine biology and environment, and raise awareness about marine environments for the community and the society.

Course Outcomes:

CO. No	Upon completion of this course, student will be able to	PSO's addressed	CL
CO-1	Gain knowledge about different zones of the sea	1	Ap, Un
CO-2	Understand the structure and function of marine coral and mangrove wetland ecosystem	7	Un
CO-3	Understand the chemical and physical properties of seawater and impact on ocean life.	7	Un, Ap
CO-4	Identify the marine organisms.	1	Un
CO-5	Conduct field research.	1	An
CO-6	Appreciate the complexity and diversity of non-living resources in the marine environment.	1	Un
CO-7	Gain new specialized skills in a range of theoretical and practical applications.	7,10	Cr
CO-8	Develop skills through either presentation research results at professional scientific meetings and or/ through pure reviewed publications.	7, 3	Cr, Ap

Semester I			
Elective II : Marine Biology			
Code: 18MLZE12	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

Unit I: Marine Environment

Classification of marine environment: Marine, Brackish, Estuaries, Mangroves, Lagoons, Coral reefs – their physico chemical features, functions of coastal and marine wetlands, values of marine and brackish water wetlands.

Unit II: Physical Oceanography

Temperature, temperature distribution in the sea – Ocean tides – generating forces, types, effects of tides in coastal areas: Waves – formation, properties and types – tsunami.

Unit III: Chemical Oceanography

Composition of sea water – Dissolved gases – dissolved inorganic, organic and particulate matter – Salinity – distribution – nutrient cycle.

Unit IV: Biological Oceanography

Biological important properties of water – Plankton and Nekton – classification of plankton, methods of collection, preservation – phytoplankton bloom.

Unit V: Marine Resources

Resources of marine environment – commercially important finfish and shellfish resources – non-living resources – minerals – salts – petroleum – natural gas, impacts of manmade activities of coastal seas, global warming and sea level rise.

Books for Reference :

1. Castro P. and M.E. Huber, 1997. *Marine Biology. Second Edition.* McGraw Hill Company.
2. Clark, R.B., 1992. *Marine Pollution 3rd Edition.* Clarendon Press, Oxford.
3. Buxbury, A.C., A.B. Duxbury and K.A. Sverdrup, 2000. *An Introduction to the World's Oceans. 6th Edition.* McGraw Hill Companies India.
4. Felix S., 2010. *Marine and Aquaculture biotechnology.* Agrobios India.
5. Kamely D, Chakraborty A & Omn GS.1990. *Biotechnology and Biodegradation.*

- Portfolio Publ. Co.
6. Fingerman M, Nagabushanam M & Thompson R. 1998. *Recent Advances in Marine Biotechnology.Vol.II.* Science Publ.
 7. MiltonFingerman and R. Nagabushanam 2003. *Recent Advances in Marine Biotechnology.Vol.8 : Bioremediation.* 8thEdition.Science Publ.
 8. Omura S. 1992. *The Searchfor Bioactive Compounds from Microorganisms.* Springer.
 9. Nagabhushanam 1997 *Fouling Organisms of the Indian Ocean* CRC Press
 10. R.Robert Clark *Marine Pollution 5th edition* Oxford University Press
 11. James W. Nybakken 1988. *Marine Biology an Ecological Approach. Second Edition.* Harper Collins Publishers.
 12. David A. Ross, 1988. *Introduction to Oceanography.Fourth Edition.* Prentice Hall.

SEMESTER -I			
Elective III : Environmental Toxicology			
Code: 18MLZE13	Hrs/week : 4	Hrs/sem: 60	Credit: 4

Vision

To offer specific education in the environmental and organismal aspects of toxicology and to develop research skills in the area of environmental toxicology

Mission

To research, educate, illustrate and communicate data and knowledge about the impacts of chemicals in the environment on health and how the health of humans, animals and the ecosystem are interconnected as one health

Course outcomes:

CO.No	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Understand fundamentals in the basic areas of toxicology	1	Un
CO- 2	Aware of the roles and responsibilities of various agencies and organizations	1	Re
CO-3	Analyse how some chemicals cause diseases among animals and humans	5	An
CO-4	Analyse how environmental contaminant exposure may affect the ecosystem	5	An
CO-5	Critically analyse current issues of environmental concern and their impact on society	5	An
CO-6	Apply their knowledge of toxicology to tackle the problems at real – world situation	7	Ap
CO-7	Design strategies for dose- response relations and evaluate the methods of exposure assessment	7	Ev
CO-8	Apply knowledge in the bioremediation of contaminated sites	6	Ap

SEMESTER -I			
Elective III : Environmental Toxicology			
Code: 18MLZE13	Hrs/week : 4	Hrs/sem: 60	Credit: 4

Unit I Introduction to toxicology

Scope of toxicology – classification of pollutants – degradable and non-degradable - sources of pollutants – monitoring pollution – pollution and environmental health – environmental laws –Toxic Control Act - National and International Agencies and Organisations.

Unit II Environmental Pollution

Air pollution – factors contributing to air pollution – sampling and methods of measurement – control – vehicular emission. Land and soil pollution – types and disposal. Water pollution – causes – types - control. Hazardant waste – radiation – treatment, disposal and management. Pollution related diseases and disorders.

Unit III Toxicology of pesticides and heavy metals

Pesticides - insecticides and herbicides – sources - mechanism of action - organochlorine, organophosphate, carbamates – environmental impacts of pesticides. Heavy metal toxicology – toxicity monitoring and exposure standards for heavy metals (Cadmium, Lead, Nickel, Mercury, Arsenic) in humans. Bio-accumulation and bio-magnification of toxic materials in food chain.

Unit IV Toxic effects on target organisms and response

Toxic chemicals – tolerance – synergism and antagonism – dose-response – dose-effect relationship – Threshold Limit Value (TLV) - bioassay tests – single species test – multispecies test – acute – sub acute toxicity test – LC 50, LD 50, EC 50 - chronic toxicity – teratogenicity, carcinogenicity and mutagenicity - chronic toxicity test.

Unit V Biotransformation and Bioremediation

Biotransformation of xenobiotics - principles – absorption and storage of xenobiotics – biotransformation of organo-chlorine and organophosphorous pesticides. Bioremediation – in-situ and ex-situ bioremediation – phytoremediation.

Books for Reference :

1. G. Tyler Miller, JR. 2006. *Environmental Science: Working with the earth, Eleventh Edition*, Thomson Brooks/ Cole, Akash Press, Delhi.
2. Singh, B.D. 2005. *Biotechnology*, Kalyani Publishers, New Delhi – 110 002.
3. Satyanarayana, U. 2008. *Biotechnology*, Book and Allied (P) Ltd, Kolkata 700010.
4. Gupta, P.K and Salunkhe, D.K. 1985. *Modern Toxicology Volume II. The Adverse Effects of Xenobiotics*, Metropolitan Book Co. [P.] Ltd., New Delhi 110002.
5. Trivedi, P.C. 2008. *Pollution and Bioremediation*, Aavishkar Publishers, Distributors, Jaipur 302 003.
6. Dubey, S.K and Soumitro Ghose. 2009. *Environmental Toxicology and Biotechnology*, Dominant Publishers and Distributors, New Delhi – 110002.