




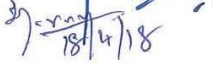
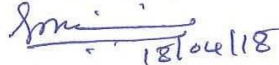

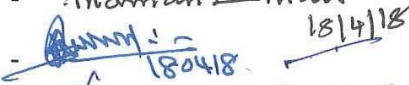






**PG AND RESEARCH DEPARTMENT OF ZOOLOGY
RAJAH SERFOJI GOVERNMENT COLLEGE (Autonomous)
THANJAVUR 613005**

**BOARD OF STUDIES MEETING
18.04.2018**

The meeting of Board of Studies (BoS) in Zoology was held on 10.30 am on 18.04.2018 (Wednesday) at the department of Zoology under the chairmanship of Dr.P.Mariappan, Head, Department of Zoology. The following members are present in the meeting

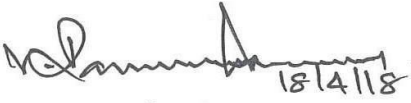




Internal Members

1. Dr.K.M.Subbu Rathinam
2. Dr.K.Rameshkumar
3. Dr. M.Sukumaran
4. Dr.S.Babu
5. Dr.S.Sivasuriyan
6. Dr.M.Thangadurai
7. Dr.P.Murugaian
8. Mr.S.Ramanathan
9. Dr. P.Raja
10. Dr.M.Sundaramoorthy
11. Dr. S.Ravikumar
12. Dr. R.Ravichelvan
13. Dr.R.Ravichandran
14. Dr.Merlin Emerald .D
15. Dr. M.Soundararajan

- 
- 
- 
- 
- 
- ARGENT -
- 
- Anaman - hand
- 
- 
- 
- 
- 
- 
- 

External Members

1. Prof. V.Ramasubramanian
2. Dr. B. Kadalmani
3. Dr. K. Venkatramalingam
4. Dr. S. Mohan Raj
5. Dr. T. Ravimanickam

-  18/4/18
-  18/4/18
-  18/4/18
-  18/4/18
-  18/4/18

The Syllabi for B.Sc. Zoology (Major and Allied), M.Sc. Zoology, and M.Phil. Zoology under CBCS system was discussed and correction/changes were made and finalized for the academic year 2018-2019 onwards. The finalized syllabus is approved in the meeting which is appended herewith.



(P.MARIAPPAN)

CHAIRMAN-BoS-ZOOLOGY

HEAD

PG & Research Dept. of Zoology,
Rajah Serfoji Govt. College (Auto),
THANJAVUR - 613 005.

**RAJAH SERFOJI GOVERNMENT COLLEGE (Autonomous)
THANJAVUR 613005**

M. Phil. Zoology

(Applicable to the candidates admitted from the academic year 2018-2019)

Sl. No	Code	Course	Title	Marks		Total	Credit
				IE	EE		
I Semester							
1	S1MZO1	CC1	Research Methodology	25	75	100	4
2	S1MZO2	CC2	Bioinstrumentation and Biological Techniques	25	75	100	4
3	S1MZO3	CC3	Teaching and Learning Skills	25	75	100	4
4	S1MZO4	CC4	Recent Advances in Zoology	25	75	100	4
5	S1MZO-A-I	CC5	Guide Paper	25	75	100	4
			Total	125	375	500	20
II Semester							
				Viva	Diss		
6	S2MECD	CC5	Project Work	50	150	200	8
			G. Total			700	28

Core Courses 5 (each 4 credits)

Project 1 (8 credits)

Total 5 (24 credits)

Guide Papers

- S1MZOA - Applied Entomology
- S1MZOB - Pheromone Technology
- S1MZOC - Aquatic Toxicology
- S1MZOD - Bioremediation
- S1MZOE - Fish Feed Formulation and Fish Culture Techniques
- S1MZOF - Aquatic Science and Fisheries
- S1MZOG - Probiotics and its Application
- S1MZOH - Ecotoxicology and Radiation Biology
- S1MZOI - Clinical Biochemistry and Microbiology

Sl. No.	Details	No of Papers
01	Core Course	5 (Each with 4 Credits)
02	Project	1 (8 Credits)
03	Total Papers and Credits	5 (24 Credits)

Separating Passing Minimum is prescribed for Internal and External

*The passing minimum for CIA is 40% (ie. 10 out of 25 Marks)

*The passing minimum for EE is 40% (ie. 30 out of 75 Marks)

* An aggregate passing minimum both CIA and EE is 50% of the total marks (100)

Credit	4	Hours/Week	6	Sub Code	S1MZO1	Semester	I
Medium of Instruction: English						CC1	

RESEARCH METHODOLOGY

(for students admitted from the academic year 2018-2019 onwards)

Objectives

At the end of this course, the scholars understand the basic concepts of research and its methodologies, identify appropriate research topics, prepare a project proposal, and write a research report and thesis. The student is also able to process and analysis the data by using appropriate statistical tool.

Course Outcome:

On completion of this course the student will

- ✓ demonstrate intermediate statistical theory and methods
- ✓ familiar with core content of at least one area in biological sciences: for example- genetics.
- ✓ be able to formulate and perform a descriptive and inferential analysis of biological data using statistical software.
- ✓ reshape the data for analysis using a programming or statistical language
- ✓ interpret the findings and have the ability of written and oral presentation of results/findings

Unit-I

Research: **Definition-types**-selection of problem - stages in execution of research. Research Report Preparation - Thesis Writing and MS preparation- **Proof reading**. Journals - types of journals - peer reviewed and non-peer reviewed, **paid and unpaid journals** - online journals- open access journals – Types and Format of Journal Articles - Short Communication - Review Articles - Research Papers – **Correspondence-Plagiarism**

Unit-II

Bibliometrics and Scientometrics - Impact Factor – Science Citation Index – H-index – **I10 index-Scopus** - Information Retrieval: access to archives and databases (literature databases), Search Engines: Google Scholar, PubMed, Online database library, Digital Library and Virtual Labs

Unit-III

Measures of Central Tendency: Mean, Mode, Median. Measures of Dispersion: Range-Mean Deviation-Standard Deviation, Standard Error, coefficient of variations

Unit-IV

Hypothesis Testing-Null and Alternate Hypothesis- **Statistical tables and their uses-levels of significance**. Comparison of Means: Students T-test, Chi-Square Analysis- One-Way ANOVA-with simple model sums.

Unit-V

Bivariate Relationships – Correlation Analysis, Types, Methods- Regression Analysis-Types and Applications with model sums. Introduction to uses of statistical software, SPSS, Excel

Reference Books

Zar, J.H. 2010. Biostatistical Analysis. Prentice Hall, Upper Saddle River, NJ.

McDonald, J.H. 2009. Handbook of Biological Statistics (2nd edition.). Sparky House Publishing, Baltimore, Maryland.

Depak Chawla and Neena Sondhi. 2016. Research Methodology. Concepts and Cases. Vikas Publishing House Pvt Ltd., Noida. Pp 790.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S1MZO2	Semester	I
Medium of Instruction: English						CC2	

BIOINSTRUMENTATION AND BIOLOGICAL TECHNIQUES

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

To understand the principles, working processes and applications of various instruments and techniques used in biochemistry, molecular biology, and microbiology. To educate the students about basic and advanced microscopic techniques. To study the micrometry and staining techniques of specimens.

Course Outcome:

After completion of this course, the students would be well versed in the following disciplines.

- ✓ Working principles of various bio instruments.
- ✓ Working principles of various bio instruments.
- ✓ Advanced instruments used in high end technology
- ✓ Applications of bio instruments in various fields such as microbiology, biochemistry and molecular biology.
- ✓ Structural prediction compounds at molecular level.
- ✓ Diagnostic applications of medical instruments such as PCR, microscopes, angiography and mammography.

Unit-I

Principle and working process of pH meter - Laminar air flow - Centrifugation – types of centrifugation, Preparative and Analytical centrifuges, Differential centrifugation, Sedimentation velocity and sedimentation equilibrium. Southern Blotting, Northern Blotting and Western Blotting. Polymerase Chain Reaction (PCR). DNA finger printing and DNA sequencing methods.

Unit-II

Chromatography: Principles, theory and applications of Paper, Thin layer, Gel filtration, Ion exchange, affinity, Gas chromatography (GC), High-pressure Liquid chromatography (HPLC) and GC-MS.

Unit-III

Electrophoresis: Principles, theory and applications of Gel eletrophoresis (AGE and PAGE), Pulse Field Gel Electrophoresis (PFGE) and Immuno electrophoresis - factors affecting electrophoresis.

Unit-IV

Principles and application of spectroscopy, Fluoroscopy, angiography, Mammography, Xero radiography, Digital radiography. Basic law of light absorption, X- ray diffraction- Colorimeter, UV- visible spectroscopy, IR, NMR and Raman spectroscopy.

Unit-V

Principles, working process and applications of microscopes: Bright and dark field microscope, Phase contrast microscope, Fluorescence microscope, Total internal reflection fluorescence (TIRF) microscope, Laser scanning confocal microscope, Scanning electron microscopy (SEM), Transmission electron microscope (TEM), Atomic force microscopy (AFM); Micrometry; Preparation and staining of specimens – fixation, dyes, simple staining, differential staining, staining of specific structures.

Reference Books

Veerakumar, L. 2006. Bioinstrumentation. MJ.P. Publisher, Chennai.

Kothari, C.R. 2008. Quantitative Techniques, S. Chand & Co. New Delhi.
Casey, E.J. (1992). Biophysics. Affiliated East – West Press Pvt. Ltd. New Delhi.
Jain, J.L. 2002. Text book of Biochemistry. Tata McGraw Hill. New Delhi.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S1MZO3	Semester	I
Medium of Instruction: English						CC3	

TEACHING AND LEARNING SKILLS

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

The objective of this course is to understand the operations and use of computers and common accessories, to develop skills of ICT and apply them in teaching learning context and research, to appreciate the role of ICT in teaching, learning and research, content in their respective subject, to appreciate the communication process through the web and acquire the knowledge of Instructional Technology and its Applications, to develop different teaching skills for putting the content across the targeted audience

Course Outcome:

- ✓ The learner will be able to understand the operating methods of computers and their accessories.
- ✓ The learns will able to know the ICT tools and their applications in teaching skills.
- ✓ The students will get acquires knowledge about advanced application of different teaching aids through computer.
- ✓ The learns acquired wise knowledge about pedagogy methods used through advance ICT methods.
- ✓ The students will develop the knowledge about EDUSAT and their uses.
- ✓ The students will be able to apply the principles of computer applications in applied sciences.

Unit I

Computer Application Skills. Computer system: Characteristics, Parts and their functions. Different generations of Computer. Information and Communication Technology (ICT): Definition, Meaning, Features, Trends–Integration of ICT in teaching and learning –ICT applications: Using word processors, spread sheets, Power point slides in the classroom–ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations

Unit II

Communication Skills. Communication: Definitions. Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise–Types of Communication: Spoken and written; Non-verbal communication–Intrapersonal, Interpersonal, Group and Mass communication–Barriers to communication: Mechanical, Physical, Linguistic & Cultural –Skills of communication: Listening, Speaking, Reading and writing –Methods of developing fluency in oral and written communication –style, Diction and Vocabulary – Classroom communication and dynamics

Unit III

Communication Technology: Bases, Trends and Developments –Skills of using Communication Technology. Computer Mediated Teaching: Multimedia, E-content –Satellite based communication: EDUSAT and ETV channels, Communication through web: Audio and Video applications on the Internet, interpersonal communication through the web.

Unit IV

Pedagogy. Instructional Technology: Definition, Objectives and Types–Difference between Teaching and Instruction–Lecture Technique: Steps, Planning of a Lecture, Delivery of a lecture–Narration in tune with the nature of different disciplines –Lecture with power point presentation –Versatility of lecture technique – Demonstration, Characteristics, Principles, Planning Implementation and Evaluation –Teaching –Learning

Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion – Models of teaching: CAI, CMI and WBI

Unit V

Teaching Skills. Teaching skill: Definition, Meaning and Nature –Types of Teaching skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board writing and Skill of Closure –Integration of Teaching Skills–Evaluation of Teaching Skills

References:

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
3. Information and Communication Technology in Education: A Curriculum for Schools and programme of Teacher development, Jonathan Anderson and Tom Van Weart, UNESCO, 2002
4. Kumar K.I (2008) Educational Technology, New Age International Publishers, New Delhi
5. Mangal, S.K. (2002) Essential of Teaching –Learning and Information Technology, Tandon Publications, Ludhiana
6. Michael D. and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York
7. Pandey S.K. (2005) Teaching Communication, Commonwealth Publishers, New Delhi,
8. Ram Babu A. and Dandapani S (2006) Microteaching (Vol.1&2) Neelakamal Publications, Hyderabad
9. Singh V.K. and Sudarshan K.N. (1996) Computer Education, Discovery Publishing Company, New York

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S1MZO3	Semester	I
Medium of Instruction: English						CC3	

RECENT ADVANCES IN ZOOLOGY

(for students admitted from the academic year 2018-2019)

Objectives

The main objective of the paper is to provide advance knowledge to the scholar in various fields of Zoology and the applications of various advanced techniques in Zoology.

Course Outcome:

On completion of this course the scholar

- ✓ Know the recent advances in zoology
- ✓ Have an idea on stem cell technology and its applications
- ✓ Have advance knowledge in molecular biology and molecular technologies

Unit-I

Environmental Biology: Global climate change factors – Human impact on earth and biodiversity; Invasive species, exotic species – Threat to animal biodiversity; Ecology of transgenic crops and animal interaction. GIS and satellite imaging in biodiversity assessment

Unit-II

Developmental Biology, Stem Cell Biology and Immunology: Differentiation, Stem cell niche in planaria, *C. elegans* and *Drosophila*; Pleuripotency of Stem cells: Embryonic and adult stem cells, organization, characteristics; Molecular mechanisms of self-renewal, pluri/multipotency and lineage; scientific approaches and challenges in stem cell therapy; Immune response to bacterial, viral and parasitic diseases and malignancy; Concept of vaccination and immunotherapy; Transplantation immunology-Basic concepts and recent advances

Unit-III

Biochemistry: Structural and functional organization of interphase nucleus - Genome organization; Co- and post translational modifications of proteins; DNA-Protein Interactions; Protein-protein interactive cloning and Yeast two hybrid system; Molecular mechanism of hormone action

Unit-IV

Molecular Biology & Biotechnology: Human genome project-landmarks on chromosomes generated by various mapping methods; Goals of human genome project and its implications on research and society; Model organisms and other genome projects; High throughput analysis of gene functions - DNA microarray; Protein array; Mass spectrometry

Unit-V

Bioinformatics, Biosafety and IPR: Sequence Databases-Types-Pairwise and Multiple sequence alignments. Phylogenetic analysis: Evolutionary change in gene and genome sequences - Branches, nodes, internal nodes, rooted and unrooted trees. Biosafety: Introduction-Historical Background-Primary Containment for Biohazards; Biosafety levels. Biosafety (Government of India) guidelines related to genetically modified organisms (GMOs) & living modified organisms (LMOs). Institutional bio-safety committee. IPR: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of GMOs IP as a factor in R&D

Reference Books:

Gilbert, S. P. Developmental Biology, 8th Edition, Sinauer Associates Inc., 2006.
A. Osborne. Immunology, 6th Edition, Freeman, 2002.
Turksen, K., Adult Stem Cells, Humana Press, 2004.

Jin Xiong, Essential Bioinformatics, 1st Edition, Cambridge University Press, 2006.

David Mount, Bioinformatics: Sequence and Genome Analysis 2nd Edition, Cold Spring Harbor Laboratory Press, 2004.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4A	Semester	I
Medium of Instruction: English						CC4	

APPLIED ENTOMOLOGY

(for students admitted from the academic year 2018-2019 onwards)

Course Objectives:

The objectives of this course are to introduce students to the ecology and biology of insects of medical and agricultural importance, provide students the opportunities to understand insect pest management techniques such as cultural, physical, Biological, chemical, IPM etc.

Course Outcome:

On completion of this course the researcher able to

- ✓ Identify main pest species belonging to class of Insecta on agricultural/medicinally important insects based on the symptoms of the attack and morphological traits.
- ✓ Describe life cycles and ecology of main pest/vector species belonging to class of Insecta.
- ✓ Plan and implement non-pesticide indirect and direct measures to prevent or reduce pest attack.
- ✓ Plan and implement plant protection according to the IPM principles.

Unit-I

Identification, Characteristics, Biology, Damage and Control of pests. Study of generalized insect: Grass hopper & Butterfly – Morphology and Anatomy. House hold pests-Cockroaches, Ants, Crickets, Clothes Moths, Carpet beetles, Furniture beetles, Cigarette beetles, House hold hairy caterpillar, Silverfish, Book louse, Wasps.

Unit-II

Stored grain pests: Rice weevil, Rice moth, Termites, Khapra beetle, Pulse beetle, Rust red floor beetle. Medicinal Pests: Mosquitoes, Housefly, Bedbug, Sand fly, Human lice, Tse Tse fly, Rat flea, Hippobosca

Unit-III

Veterinary pests – mosquitoes, sand fly, Horsefly, Blowflies, stable fly, warble fly, crew worm fly, fleas. Forest Pests - Termites, leaf miners, *Pteroma plagiopelops*, *Hypsa ficus*, *Eumeta crameri*, *Spodoptera litura*, *Eutectona machearalis*, *Hyblea puera*, *Acherontia sty*, *Inderbella sp.*, *Sahyadrassus malabaricus*, Bamboo leaf roller, Spruce bud worm, Lyctus beetle, Achea janata, Sal borer, Spilosoma oblique, gall midge, *Batocera rufumaculata*, lace wing bug, Anomala bengalensis.

Unit-IV

Sericulture: Types of silk worms (Mulberry & Nonmulberry), Rearing of Mulberry Silkworm, Diseases and pests of silk worm. Apiculture-types of bees-bee hives. Insects on human food. Lac culture-cultivation practices of host plants, extraction and uses of lac, pest and diseases of lac insect

Unit-V

Pest and vector control. Integrated pest management. History, different phases of pest control, Quarantine, Physical, Cultural, Chemical, Biological control and, genetic and biotechnological methods of control. Pheromones-production, and their use in pest surveillance and management.

Text Book:

Tanweer Allam Et al. 2015. A Text Book of Fundamental and Applied Entomology. 2015. Kalyani Publishers.

Reference Books:

Awasti V.B. 2009. Introduction to general entomology. 3rd Ed. Scientific Publication (India), Jodhpur

Awasti V.B. 2007. Agricultural Insect Pests and their control. Scientific Publishers, Jodhpur

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4B	Semester	I
Medium of Instruction: English						CC4	

PHEROMONE TECHNOLOGY

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

To enrich the knowledge about the various types of pheromones and their role in microbes and aquatic animals, to evaluate the pheromones in integrated pest management, to examine the importance of pheromones in animal production and understand the concept of pheromone carrier proteins

Course Outcome:

On successful completion of this paper the scholars will gain knowledge on

- ✓ The classification, types and nature of the pheromones
- ✓ The effect of primer and releaser pheromones in the aquatic organisms
- ✓ The role of pheromones in the integrated pest management and also they know the merits and demerits of pheromones in pest management.
- ✓ The importance of pheromones in the reproductive behaviour of farm animals.
- ✓ The handling of various bio instruments related to identifying the odorant binding proteins.

Unit-I

Semiochemicals: Classification–pheromones, definition, types - primer, releaser, signaling and imprinting; allelochemicals, definition, types–kairomone, allomones, synomones and apneumones: sources, chemistry and nature of pheromones.

Unit-II

Microbial and aquatic pheromones: Pheromones in yeast, bacteria and protozoa. Peptide pheromones in crustacean and mollusca; - primer and releaser pheromones effects in gold fish; Migratory pheromones in lamprey; sex pheromones in urodeles.

Unit-III

Pheromones in integrated pest management: Trail, alarm, aggregation and sex pheromones in insects and their role in pest management, pheromones in masking the poison based shyness in rodents ; Methods of pheromone application in insects and rodents- role in IPM. Merits and demerits in using pheromones for pest management.

Unit-IV

Pheromones in animal production: Reproductive behavior in farm (sheep, goat, pig, cow and buffalo) and wild animals (antelope, elephant and tiger); Bio- stimulation in farm animals; Conservation in wild animals with help of pheromones. Human pheromones menstrual synchronization, necklace experiment, armpit and sweat odors.

Unit-V

Pheromone carrier/binding proteins and techniques:General characters of Lipocalin. Pheromones binding proteins-major urinary protein (mice), alpha 2μglobulin (rat) albumin (elephant), aphrodisin (hamster) and apolipoprotein D (human); Odorant – binding protein – main olfactory system (MOS) and accessory olfactory system (AOS); in pheromones perception. Techniques- SDS-PAGE, Western blot, MALDI – TOF, MS – Edman's degradation Tandem MS; Gel and ion exchange chromatography; GC-MS Y maze apparatus and olfactometry.

Reference Books

G. Vandenbergh, 1984. Mammalian Reproductive Pheromones. Academic Press.

D.L. Moulton and J.W. Johnson. 1976. Methods in Olfactory Research. Academic Press.
A. Marchlewska and A. Muller- Schwarze. 2001. Chemical Signal in Vertebrate Plenum Press.
R. Van Den Hurk. 2007. Intra-Specific Chemical communication in Vertebrates with special attention to its role in reproductive. Pheromone Information Centre, the Netherland.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4C	Semester	I
Medium of Instruction: English						CC4	

AQUATIC TOXICOLOGY

(for students admitted from the academic year 2018-2019 onwards)

Objectives

Aquatic toxicology aims to study the mode and mechanisms of entry of these pollutants into the aquatic ecosystem and to elucidate, not only their fate, but also the potential impacts, hazards and risks posed by these compounds on the health of individual organisms and the community structures they inhabit. One of the major hurdles in aquatic toxicology is establishing "cause-effect" relationships

Course Outcome:

Student completing this course will be able to.

- ✓ Explain the aquatic and thermal pollution
- ✓ Elucidate the metabolism of toxic substance, synergetic and antagonistic effects.
- ✓ Recognize the heavy metal, and pesticide pollution.
- ✓ Analysis the LC50 and LD50 values.
- ✓ Summaries the sublethal toxicity on biochemical composition and histological alternations.

Unit-I

Aquatic Pollutions: Introduction to Aquatic Pollution. Marine Pollution. Petroleum and related compounds. Oil pollutants, Radionuclides and Thermal pollutions

Unit-II

Metabolism of toxic Substances: Uptake, Excretion, Chemical localization and its consequences of toxic substances in animals. Hepatic metabolism, Synergetic and Antagonistic effects,

Unit-III

Toxic Substances: Heavy metal pollutants: Mercury, Cadmium, Copper, Lead, Manganese, Nickel, Vanadium, Zinc, Arsenic, Iron and Chromium. Pesticide pollutants: Organochlorines, Organophosphorus and Carbamates.

Unit-IV

Safety evaluation of toxicants: Environmental Evaluation of Combined Toxicity of Toxicant Mixtures, Role of LC 50 or LD 50 Values in Safety Evaluation of Toxicants. Dose-response relationship: Selected toxicological methods: Evaluation of Toxicity of Pollutant, in Aquatic Organisms and Terrestrial Organisms

Unit-V

Sublethal Toxicity: Evaluation of Sublethal Toxicity-Histopathological Alterations, Hoemopoietic Activity, Oxygen Consumption, Physiological activities and Biochemical constituents

Reference text book

Fundamentals of Aquatic Toxicology: Effects, Environmental Fate and Risk Assessment. 1995. Gary M. Rand. CRC Press, Pp 1125.

An Introduction to Aquatic Toxicology. 2014. Mikko Nikkinmaa. Academic Press. Pp 252.

De Bruin, A. 1977. Biochemical Toxicology of Environmental Agents. Elsevier, Amsterdam.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4D	Semester	I
Medium of Instruction: English						CC4	

BIOREMEDIATION

(for students admitted from the academic year 2018-2019 onwards)

Course objectives:

To enhance the understanding of student on various bioremediation approaches, metabolic pathways involved in bioremediation, role of genetic engineering in bioremediation and various waste treatment techniques.

Course Outcome:

Course outcome: Students completing this course will be able to

- ✓ Compare and contrast bioremediation approaches and explain the advantages and factors influencing bioremediation.
- ✓ Describe bioremediation processes and genetic engineering approaches.
- ✓ Recognise the role of biotechnology in pollution control.
- ✓ Outline liquid and solid waste management and limitations of bioremediation.
- ✓ Give an account of industrial and mining waste treatments.

Unit-I

Bioremediation approaches: Biostimulation, bioaugmentation, biosorption, bioaccumulation; environmental clean up by microbes; phytoremediation for soil decontamination; advantages of bioremediation; factors affecting bioremediation.

Unit-II

Bioremediation processes and genetic engineering approaches: Biodegrading agents; metabolic pathways for degradation of hydrocarbons, pesticides, polychlorinated biphenyls; construction of superbug; molecular techniques involved in bioremediation.

Unit-III

Biotechnology in pollution control: Role of biotechnology in Pollution control; environmental monitoring; environmental impact assessment; biosensors; DNA probes; air pollution treatment - biofiltration, biotrickling filtration, bioscrubbers, carbon dioxide sequestering.

Unit-IV

Liquid and solid waste treatments: Sewage treatment – primary treatment, secondary treatment, tertiary treatment; compost making – Indor method, Bangalore method; vermicomposting – pit method, bed method; Limitations to bioremediation – bioavailability, toxicity and molecular size.

Unit-V

Treatment of industrial and mining wastes: Bioremediation of hydrocarbons, pesticides, industrial solvents; Biomining - bioleaching, biobenification, metals removal from water, microbial enhancement of oil recovery.

Text Book

Dubey, R.C. 1995. Text Book of Biotechnology. S. Chand & Co.

Reference Books

McEldowney, S., D.J. Hardman and S. Waite. 1993. Pollution: Ecology and biotreatment, Longman scientific technical.

Baker, K.H and D.S. Herson, 1994. Bioremediation, Mc.GrawHillInc, NewYork.

Balasubramanian, D., C.F.A. Bryce, K. Dharmalingam, J. Green, K. Jayaraman, 1996. Concepts in Biotechnology. Universities Press Ltd., Hyderabad.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4E	Semester	I
Medium of Instruction: English						CC4	

FISH FEED FORMULATION AND FISH CULTURE TECHNIQUES

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

To study the fish feed and preparation of food, To understand the present status of fishculture techniques, To study the engineering and culture system of fishes, To know induced breeding and pathology of fish culture techniques

Course Outcome:

- ✓ Understand feeding standard, various livestock.
- ✓ Describe and discuss method of fish feed formulation.
- ✓ Identify the purpose of premix how it can be formulated and included in feed.
- ✓ Fish provide nutrition and micro nutrients that are essential to physical development in children.
- ✓ Describe the role of protein, fat, carbohydrate, vitamin in fish nutrients.

UNIT-I

Principles of feed formulation preparation of artificial feed, types of artificial feed, Feeding rates, feeding schedule, feeding methods, problem in artificial feed, pellets, live feed cultures, algae, artemia daphnia and Brachionus.

UNIT-II

Nutritional requirements of fish composition of an ideal fish feed qualities of good artificial feeds food conservation ratio (FCR) Natural feed.

UNIT-III

Scope of aquaculture-Aquaculture in India, preparation of ponds pond constructions type of ponds maintenance of ponds. Water quality management in fishculture ponds.

UNIT-IV

Culture of organising, culture of Indian major carps, and culture systems fish diseases and their control classification of fish diseases.

UNIT-V

Culture techniques mono culture polyculture integrated fish farming ornamental fish culture hypophysation seed collection crafts & gears preservation of fish – fish marketing economic importance of fishes.

Reference Books

G.Santhanakumar and A.M.Selvaraj. 2002. Concepts of Aquaculture. Meenam Publication.
 N. Arumugam. 2008. Aquaculture, Saras Publication
 V.G. Jhingram 1988 Fish and fisheries of India. Hindusthan publishing co (India) New Delhi

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4F	Semester	I
Medium of Instruction: English						CC4	

AQUATIC SCIENCE AND FISHERIES

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

Objective of Aquatic Science and Fisheries is to understand the scope, types and research in aquaculture and fisheries, to create awareness on finfish and shellfish culture, to learn about fish feed and diseases of aquatic organisms and to explain the aquatic pollution and water quality management.

Course Outcome:

Unit-I

Introduction to aquaculture: Scope of aquaculture–Types of fisheries-Strategies in aquaculture and fisheries – Area available for aquaculture and fisheries – culture practices in India.

Unit-II

Types of fish ponds: Construction of fish ponds. Maintenance of fish farms. Hypophysation technique. Fin fish culture. Integrated fish culture.

Unit-III

Ornamental fish culture. Shell fish culture. Culture of freshwater prawn. Pearl and edible oyster culture. Sewage feed fish culture. Water quality management - Fish diseases.

Unit- IV

Fish feed: Live feeds and their culture. Types of artificial feed. Preparation of artificial feed. Feeding methods.

Unit-V

Crafts and Gears. Fish Preservation. Fish marketing. Economic importance of fish culture.

Reference Books

S.S.Khanna and H.R.Sing. 2014. A Text Book of Fish Biology and Fisheries. Narendra Publishing House, New Delhi.

Paul J.B.Hart and John D.Reynolds, 2008. Hand Book of Fish Biology and Fisheries, 1st edition, Wiley Blackwell , North America.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4G	Semester	I
Medium of Instruction: English						CC4	

PROBIOTICS AND ITS APPLICATION

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

To impart current knowledge of probiotics, prebiotics and functional dairy foods for the health benefits

Course Outcome:

At the end of the course the students will be able to:

- ✓ Critically evaluate products containing probiotics, both from a microbiological and technological point of view.
- ✓ Furthermore, students will be able to establish the most suitable criteria for the selection of a microorganism to be used as a probiotic and Prebiotic and for the scientific evaluation of its effectiveness.
- ✓ Briefing the specializations in the field of dairy and Non dairy Probiotics food product and food safety
- ✓ Understanding of structure and function of human intestine and development of beneficial microorganism.
- ✓ Learn about the techniques and its applications of probiotic products on food

Unit-I

Definition of probiotic - Probiotic health benefits-Food application of probiotic –Its application challenges.

Unit -II

Nutritional program of probiotics – Prebiotic gut flora management tools-Efficacy of prebiotics across the life span – Prebiotic as therapeutics-Its efficacy in human disease.

Unit -III

Probiotic food products- Safety of probiotic bacteria – FAO / WHO approach – Non-dairy probiotic products. Application of probiotic bacteria in dairy foods.

Unit -IV

Schematic representation of gastro intestinal tract in human - Selection of probiotic microorganisms – Beneficial effect of probiotics and its role.

Unit -V

Techniques for the addition and production of probiotic in dairy products – Production flow chart of for ice cream and cheese with probiotic.In vitro tests to evaluate probiotic capacity.

Reference Books

FAO/WHO. 2001. Health and Nutritional Properties of Probiotics in Food including Powder Milk with Live Lactic Acid Bacteria. Cordoba, Argentina: Food and Agriculture Organization of the United Nations and World Health Organization Expert Consultation Report.

Barrangou R, Lahtinen S, Ibrahim F, Ouwehandac (2011) Genus Lactobacillus. In: Lactic Acid Bacteria: Microbiological and Functional Aspects. London: CRC Press. pp. 77-91.

Kopp-Hoolihan L 2001. Prophylactic and Therapeutic Uses of Probiotics: A Review. Journal of American Dietary Association; 101(2) 229-241.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4H	Semester	I
Medium of Instruction: English						CC4	

ECOTOXICOLOGY AND RADIATION BIOLOGY

(for students admitted from the academic year 2018-2019 onwards)

Objectives

The main aim of this paper is to give information about the environment of biotic and abiotic factors, the toxicant related with environment and heavy metal pollution. To gain the broad knowledge of environmental radiation biology, types of radiation unit and its measurement.

Course Outcome:

On completion of this course, students should be able to:

- ✓ Understand and appreciate abiotic and biotic factors, General Principles of Toxicology- Bioassay, Toxicant effects major living and non-living components of regional and global environment.
- ✓ Critically evaluate the heavy metal, Petroleum related compounds, oil pollutants and thermal pollutions in aquatic and terrestrial organisms.
- ✓ Describe basic knowledge about sources, types and specific units for various measurements and dosimetric calculations of ionizing radiations.
- ✓ Understand the measurement principles and accumulation pattern of selected radiation in water, nuclear energy programmes and its waste management.
- ✓ Gain consolidated knowledge about primordial radionuclides, HBRA and application of radiation in oncology.

UNIT-I

Definition, Scope of Ecology Abiotic and Biotic factors- General Principles of Toxicology: Introduction – Definition – Types - Scope of toxicology Toxicity tests: Dosage, dose response - Acute toxicity tests: Bioassay, LC50 and LD50. Toxicant effects – molecular effects and biomarkers, sub lethal, acute and chronic effects. Impact of toxic chemicals on enzymes and hormones-Environmental toxicology of nanoparticles/materials.

UNIT-II

Evaluation of Toxicity of Pollutant, in Aquatic Organisms and Terrestrial Organisms. Heavy metal pollutants: Mercury, Cadmium, Copper, Lead, Manganese, Nickel, Vanadium, Zinc, Arsenic, Iron and Chromium. Pesticide pollutants- Water Pollutions: Petroleum and related compounds, oil pollutants and thermal pollutions.

UNIT-III

Scope of Radiation Biology – Sources of natural radiation: Terrestrial and cosmic sources.- Man made Radiation -Nuclear activities (Nuclear fuel cycle, Nuclear Test, Nuclear accidents, Mining)- Types of radiation (Alpha, Beta & Gamma)- Properties of Radiation (external emitters and internal emitters)- Radiation Units (Becquerel, RAD, Gray , Curie & Sievert).

UNIT-IV

Environmental radiation in water, Sediment and Biota- Bioconcentration factor–Bioaccumulation of Radionuclides (Po-210 and Pb-210) in aquatic organisms - Bioindicator organisms. Measurement of radiation in the environment: Alpha counter –Beta Counter and Scintillation counter. Nuclear reactors – Nuclear energy Programme in India – Radiation Protection – Principles and practices- Radioactive waste sources and Management.

UNIT-V

Radiation in terrestrial environment – Distribution of radioactive substances in Land (Primordial radionuclides ^{238}U , ^{232}Th and ^{40}K) Low Background Radiation Area (LBRA) and High Background Radiation Area (HBRA). (National and World levels)- Indoor Radon and health hazard. Effect of radiation – Radiation sickness – Syndrome- Radio therapy and Treatment – Radiation oncology.

Reference Books:

Odum, E.P. Fundamentals of Ecology. W.B. Saunder's Co. Philadelphia.1971.
Grosh, D.S. Biological Effects of Radiation, Blaisdell Publishing Co. 1965.
Bascq, Z.M. and Alexander, P. Fundamentals of Radiobiology. 1961.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	3	Sub Code	S1MZO4I	Semester	I
Medium of Instruction: English						CC4	

CLINICAL BIOCHEMISTRY AND MICROBIOLOGY
(for students admitted from the academic year 2018-2019 onwards)

Objectives

This course enables the scholars taking research in the field of protein based drug discovery against infectious diseases to understand the basic concepts of protein molecules and clinical pathogens .

Course Outcome:

After completion of this course, the students would be well versed in the following disciplines.

- ✓ Types and properties of proteins
- ✓ Immunoglobulins and antimicrobial peptides
- ✓ High end techniques for protein/ peptide detection
- ✓ Common human pathogens
- ✓ Consequences of multidrug resistance in pathogenic microbes
- ✓ Bacterial and fungal culture techniques

Unit-I

Amino Acids: Biomedical Importance, properties and classes, charges, solubility and melting points. Protein Structure: Primary, secondary, tertiary and quaternary structures of proteins.

Unit-II

Immunoglobulins: Classes, structure and functions – passive antibody therapy – organization and expression of immunoglobulin genes. Antimicrobial Proteins/Peptides: Distribution, properties, classes and therapeutic uses.

Unit-III

Protein protocols: Quantification of proteins by UV absorption, Lowry, Bradford and Biurette methods-Flow cytometric quantification of cellular proteins – Chromatographic techniques of protein purification; Affinity, Gel Filtration, Ion exchange, HPLC and RP-HPLC - SDS-PAGE, 2D Gel Electrophoresis – Blotting techniques.

Unit-IV

General features and classification of Microbes: virus, bacteria and fungi-Human diseases caused by bacteria; Enteric fever, tuberculosis, cholera, STD and gonorrhoea. Classical antibiotics and bacterial resistance

Unit-V

Microbiological techniques: Physical and chemical methods of sterilization, simple staining, Gram staining - Culture media and types – primary and secondary culture – antimicrobial tests.

Reference Books:

Biochemistry. Jeremy M. Bery, Jonh L. Tymoczko, Lubert Stryer. Fifth Edition
Harper's Illustated Biochemistry. Robert K. Murry, Daryl K. Granner, Peter A. Mayes, Victor Rodwell. Twenty sixth Edition
Immunology. Kubey. Seventh Edition
Microbiology by Lansing M. Prescott. Fifth Edition
The protein protocols-Hand Book by John M. Walker. Humana press inc Second Edition

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs