

# **SYLLABUS**

## **M.Phil., ZOOLOGY**

**(For candidates admitted from the Academic year 2017 Onwards)**



**P.G. DEPARTMENT OF ZOOLOGY  
JAMAL MOHAMED COLLEGE (AUTONOMOUS)**

**(Nationally Accredited with 'A' Grade by NAAC)**

**TIRUCHIRAPPALLI- 620 020.**

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(Nationally Accredited with 'A' Grade by NAAC)

TIRUCHIRAPPALLI- 620 020.

**P.G. DEPARTMENT OF ZOOLOGY**

**M.Phil., ZOOLOGY PROGRAMME – (CBCS Pattern)**

(For candidates admitted from the Academic year 2017 Onwards)

Semester	Paper	Course Title		Credits	Marks		Total	
					Internal	External		
I	Paper –I	Research Methodology		4	40	60	100	
	Paper – II	Advances in Biological Research		4	40	60	100	
	Paper – III*	1	Biology of Insect Reproduction		4	40	60	100
		2	Groundwater Biology					
		3	Aquaculture and Hydrology					
		4	Vermiculture Technology					
		5	Bioremediation					
		6	Environmental Biology					
		7	Environmental Microbiology and Microbial Techniques					
		8	Radiation and Environment					
		9	Radiation Ecology					
		10	Molecular Toxicology					
		11	Mosquito Control					
	12	Conservation Biology						
13	Ecobiotechnology							
Paper –IV	Teaching and Learning Skills.		4	40	60	100		
II		Dissertation		8	Thesis =150	Viva=50	200	
		<b>Total</b>		<b>24</b>			<b>600</b>	

*\* Topic of Research – Guide Paper*

**SEMESTER I: CORE I  
RESEARCH METHODOLOGY**

**Course Code : 17MPZO1C1**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

**Objective:** To expose students to the concept of research and to provide a background knowledge on the application of research tools.

**UNIT – I:** Research – Objectives – Types, Importance and Processes – Literature survey – Printed and online journals – Refereed journals, Impact Factor, Citation Index. Abstracts and Indices – Technical papers – Reviews – Monographs – Preparation of Index cards – Use of Internet in Literature survey. Identification and selection of Research Problem – Experimental design – Planning and execution of investigation. Preparation and Writing of Thesis: Components of thesis; Preparing of scientific papers for publication to a Journal and presenting in symposia/seminar.

**UNIT – II:** Model organisms – culture and maintenance. CPCSEA regulations – Patent. Spectrophotometry (Principle, types, description and applications). Centrifugation (Principles, types, description and applications). Chromatography: Ion – exchange chromatography, GLC and HPLC (Principles, description and applications). Electrophoresis – Types: –PAGE, SDS-PAGE, 2D Electrophoresis. Immunoelectrophoresis – ELISA – Blotting techniques – Southern, Western and Northern – Principle and applications.

**UNIT – III:** Microtechnique: Permanent mounting – Narcotization and Killing – fixing – washing – Tissue processing – Staining – mounting – Labeling. Histochemistry – Carbohydrate, Protein, Lipid and Nucleic acids. Microscopy: Types, Principle and applications of Light microscopes and Electron microscopes (SEM and TEM) Studies – Histological preparation of tissues for SEM and TEM. Photomicrography: principle and applications.

**UNIT-IV:** Methods in Microbiological Studies: Isolation and culture of microorganisms – mixed cultures; physical chemical and biological methods. Methods of isolation and

maintenance of pure culture. Microbial growth – growth curve of bacteria – measurement of growth. Culture media – characteristics – types and preparation. Staining and smearing.

**UNIT V:** Statistical Methods: Hypothesis testing. Tests of Significances: Student's "t" test, F – Test – One way and Two way ANOVA with interpretation of data – Multiple comparison tests – LSD, SNK, DMRT. Correlation and regression: Correlation (Pearson's and Spearman's Rank), partial and multiple correlation – simple linear regression and multiple regressions. Non-Parametric Tests: Chi square, Mann Whitney "U", Wilcoxon's test and Kruskal Wallis tests.– use of SPSS for statistical analysis.

**List of Books for References:**

1. Anderson, D. P. 1970. Thesis and Assignment Writing, Wiley Eastern Limited.
2. Grumani, N. 2006. Research Methodology for Biological Sciences. MJP Publishers, Chennai. P 753.
3. Pelczar, M.J. and R.D. Reid. 1996. Microbiology. Tata Mc Graw Hill, New Delhi.
4. De Robertis, E.D.P. and De Robertis, E.M.F. 1995. Cell and Molecular Biology. 8<sup>th</sup> Edition, B.I. Waverly Pvt. Lid., New Delhi.
5. Das, H.K (Editor) 2005. Text book of Biotechnology. Wiley dreamtech India Pvt Ltd., New Delhi.
6. Daniel, W.W. 2000. Biostatistics – A foundation for analysis in the Health sciences. John Wiley and Sons, New York.
7. Gupta, P.K. 2004. Biotechnology and Genomics (I Edition) Rastogi Publications, Meerut.
8. Ivan Roitt, David Male, and Jonatham Brostoff. 2002. Immunology. Mosby Edinbrugh, London.
9. Palanichamy, S. and M. Shunmugavelu, 1997. Research Methodology in Biological sciences. Palani Paramount publications, Palani.
10. Pearson. Histochemistry Vol. I & II.
11. Zar, J.H. 2003. Biostatistical Analysis. Pearson Education Asia, New Delhi.
12. Dubey, R.C and Maheshwari, D.K. 1999. A text book of microbiology. S.Chand &Co Ltd., New Delhi.

**SEMESTER I: CORE I  
ADVANCED IN BIOLOGICAL RESEARCH**

**Course Code : 17MPZO1C1**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

**Objective:**

To study the recent advances in molecular genetics and biotechnology: Also to understand then benefits to improve man's quality of life.

**UNIT – I: Environmental Biology:** Pollution Abatement Measures: Bioremediation – Solid Waste Management – Biofertilizers and Biopesticides – Environmental Impact Assessment (EIA) – Environmental Laws in India. **Biological Diversity:** Types – Genetic, Species and Ecosystem diversity – Values of biodiversity – Biodiversity indices: Alpha, beta and gamma – Threats to Biodiversity – IUCN Categories – Red Data Book – Conservation of biodiversity – *ex situ* and *in situ*. GPS, GIS, Remote sensing and Radio telemetry techniques used in Ecological Research – Molecular Markers in Genome analysis – RFLP, RADP, AFLP and their applications in Biodiversity.

**UNIT – II: Microbiology and Microbial Techniques:** Microbial diversity – Prokarya – Eukarya and Viruses – Microbial diseases of Man – Bacterial, Fungal, Viral diseases – Chemotherapy and antibiotics – Vaccines – rDNA Vaccines – applications. Molecular mapping of genome – Genome organization. Cloning technology and its application in biology – Ethical issues – Terminator genes – Merits and demerits.

**UNIT – III: Immunological Techniques:** Antigen – Antibody interactions – Isolation of pure antibodies – Assays of complement – Assays for circulating immune complexes – Isolation of lymphocyte populations Effector cell assays, Gene targeting Immunological techniques in medical diagnosis – HIV, Hepatitis A & B, Cancer and Pregnancy.

**UNIT – IV: Animal Biotechnology:** Basic techniques of Mammalian cell cultures – Cell lines – Manipulation of cultured cells and tissues – Application of Animal cell cultures – Stem cell cultures – Apoptosis – Protein Engineering – Transgenic animals – Advantages. Gene Therapy. Human Genome Project – DNA fingerprinting and its applications – Biosensors and

Biochips and their Applications – **Plant Biotechnology:** Explants and their incubation – Regeneration of plants from callus – Applications of Tissue cultures – Transgenic plants – IPR and Patent Rights.

**UNIT – V: Bioinformatics:** Scope of Bioinformatics – Genomes and Proteomes – The genome of *Homo sapiens* (the human genome). Single Nucleotide Polymorphisms. Biological Databases – Primary, Secondary, Specialized and Structural database. Databases searches for homologous sequences – FASTA, BLAST and molecular docking. Local and global alignment concepts – Clustal-W –Phylogenetic trees – clustering methods.

**List of Reference Books:**

1. Krishnamurthy, K.V. 2004. An advance Text book on Biodiversity. Principles and Practice. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Das, H.K. (Editor) 2005. Text Book of Biotechnology. Wiley Deramtech India Pvt. Ltd., New Delhi.
3. Jogdand, S.N. 2004. Advances in Biotechnology. Himalaya publishing House, Mumbai.
4. Benjamin Lewin. 1999. Genes VII. Oxford University Press, New York.
5. Kumar, H.D. Modern concepts of Biotechnology. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Kumar, D and Kumar, S. 1998. Modern concepts in Microbiology, Vikas Publishing house Pvt. Ltd., New Delhi.
7. Ivan Roitt, David Male and Jonatham Brostoff. 2002. Immunology. Mosby Edinburgh, London.
8. Anathanarayanan, R, and C.K., Jayaramam Paniker. 1990. Text book of Microbiology. Orient London.
9. Pelczar, M.J. and R.D. Reid. 1996. Microbiology. Tata McGraw Hill.
10. De Robertis, E.D.P. and De Robertis, E.M.F. 1995. Cell and Molecular Biology. 8<sup>th</sup> Edition, B.I. Waverly Pvt. Lid., New Delhi.
11. Attwood, T.K. and PLarry – Smith, D.J. 2002. Introduction to Bioinformatics, Pearson Education (Singapore).
12. Lesk, A.M., 2007. Introduction to Bioinformatics (S.E.), Oxford University, Oxford.
13. Mani, K. and Vijayaraj, N., 2004. Bioinformatics. A Practical Approach, Aparnaa publications, Coimbatore.
14. Murthy, C.S.V., 2003. Bioinformatics, Himalaya Publishing House, New Delhi.
15. Sundararajan, S. and Balaji, R. 2002. Introduction to Bioinformatics, Himalaya Publishing House, New Delhi.
16. Westhead, D.R., Parish, T.H. and Twyman, R.M., 2003. Instant Notes: Bioinformatics BIOS Scientific Publisher Ltd, Oxford, UK.

## BIOLOGY OF INSECT REPRODUCTION

**Course Code : 17 MPZO03**

**Hours/Week : 4**

**Credit : 4**

**Max Marks : 100**

**Internal Marks : 40**

**External Marks : 60**

### **Unit: I**

Gonadal differentiation – Spermatogenesis, Oogenesis with special reference to vitellogenesis - vitellogenins and vitellins.

### **Unit: II**

Mating and Mating behavior in Arthropods – Courtship and mating behavior , Sex recognition and environmental factors influencing mating behavior – Pheromones and their role.

### **Unit: III**

Sperm transfer – Sperm transfer via spermatophores – Direct sperm transfer – Factors influencing sperm activation and sperm migration.

### **Unit: IV**

Egg production and fecundity – Nutritional, environmental and mating stimuli – Oviposition. Endocrines control of reproduction – Hormonal control of male reproduction – Hormonal influence on egg maturation. Hormonal control of vitellogenesis and hormonal control of oviposition.

### **Unit: V**

Male and female accessory reproductive glands (ARGS) – Chemical nature of secretions and their function – Hormonal control of accessory secretions. Other forms of reproduction – Asexual reproduction and parthenogenesis – Viviparity.

### **Reference:**

1. Adiyodi, K.G. and Adiyodi, R.G., 1983. Reproductive Biology of Invertebrates. Vol.I and II. New York.
2. Engelmann, F.1970. The physiology of Insect Reproduction, Vol.44, Pergamon press, Oxford, London.
3. Geise, A.C. AND Pearse, J.S.1974-1978, Reproduction of marine Invertebrates, Vol.I to V Adamic press, New York.
4. Nayer, K.K. Elements of Insect Endocrinology.
5. Gupta, A.P. 1979. Arthropod phylogeny, Van Nostrand Reinhold CO., New York.





**PART - I: PAPER - III**  
**GROUNDWATER BIOLOGY**

**Course Code : 17 MPZO03**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

**Unit I**

**Water Pollution** types of water pollution- Ground water pollution- Harmful effects of ground water pollution-groundwater contamination- Protecting ground water from pollution- Fluoride pollution- dangers of water fluoridation – oil pollution of water- control of oil pollution. Properties of water – Hard and soft water – composition of natural waters – world water distribution – Hydrocological cycle- water budget- Groundwater budget.

**Unit II**

Source of water pollution – sewage and domestic wastes- Harmful effects of sewage and domestic wastes- Industrial effluents- Harmful effects of industrial pollutants- Agricultural discharges- Fertilizers- effects of fertilizers- detergents- toxic metals- siltation- Thermal pollutants- effects of thermal pollution- radioactive materials in water- effects of radioactive pollutants.

**Unit III**

Classification of water pollutants- Inorganic pollutants and toxic metals- detrimental effects of inorganic pollutants- Sediments- Oxygen demanding wastes- disease causing agents- effects of pathogens- effects of pesticides- effects on man effect on animal effect on birds- Farm wastes. Microbiology of drinking water sewage- Escherichia coli as water pollution indicator- effect of environments of growth of micro organisms- Life of micro organisms in water system and sewage treatment plants.

**Unit IV**

Analysis of water pollutants- Chemical and physical examination of water preservation and preconcentration method- Measurement of water quality by chemical and physical examination of water – major causes – BOD- suspended solids – acids or alkalies – Ammonia – Phenols – Sulphides – Colour – Odour - Bacteriological examination of water- standards for bacteriological quality- standards prescribed by WHO- Standard prescribed by ISI

## **Unit V**

Water management – use and conservation of water resources – water quality management- water management in India – prevention and control of water pollution – water pollution control Act – waste water treatment methods – recycling and reuse of waste water – Monitoring management in India – water scarcity- Future water problem in global level – Water problem in India- Environmental education. EIA – Environmental planning and decision making – various methods of EIA – methods for identification of effects and impacts ( checklists methods for prediction of effects, methods of interpretation of impacts).

### **Text book recommended:**

1. Water Pollution B.K.SHARMA Goel Publishing House Meerut.
2. Environmental pollution management and control for sustainable development. R.K.KHITOLIYA. S.CHAND Company LTD RAM NAGAR, New Delhi-110055.
3. Ecology and Environment; P.D. SHARMA Published by Rakesh Kumar Rastogi for Rastofi Publications, Ganootri Shivaji road, Meerut-250002.
4. Animal ecology and distribution of animals. Veera Bala Rastogi Published by KEDAR NATH RAMNATH 132, R.G. College road, Meerut-250001(UP)

## **AQUACULTURE AND HYDROLOGY**

**Course Code : 17 MPZO03**

**Hours/Week : 4**

**Credit : 4**

**Max Marks : 100**

**Internal Marks : 40**

**External Marks : 60**

### **UNIT I**

Water – characteristics of marine water, fresh water and brackish water; Aquatic systems – Lotic and Lentic ground water – Hard and soft waters; Waste water – Sewage, Effluent.

### **UNIT II**

Sampling of Water - Water quality parameters – pH, conductivity (Salinity, TDS) CO<sub>2</sub>, DO, BOD, COD, Chlorides, Acidity, Alkalinity, Hardness, Sulphate, Fluoride.

### **UNIT III**

Nutrients in water – Nitrogen (General Ammonia, Nitrate, Nitrite), Organic phosphorus chlorophyll; Eutrophication; Plankton; Sampling identification and counting.

### **UNIT IV**

Aquaculture – definition, Scope, Aquaculture in India, Fresh water, Coastal and marine. Aquaculture, cultivable organisms and their qualities; Pond – Types – Preparation of Pond for fish culture – management of soil and water quality.

### **UNIT V**

Aquaculture practice – maintenance and monitoring pond – Feed – Artificial and live – Disease of aquaculture organisms – Treatment – Harvesting processing and handling.

### **Reference:**

1. American Society for Testing and Materials. (1997). Annual book of ASTM stds Vol. 11.01. American Soc. Testing & Materials. Philadelphia, Pa.

**PART - I: PAPER - III**

**VERMICULTURE TECHNOLOGY**

**Course Code : 17 MPZO 03**

**Hours/Week : 4**

**Credit : 4**

**Max Marks : 100**

**Internal Marks : 40**

**External Marks : 60**

**UNIT I:** Scope of Vermiculture – Earthworm Taxonomy – Morphology, Anatomy and Physiology of earthworms.

**UNIT II** Vermicomposting and its types – Role of earthworms in composting – Vermicast. Vermitechnology and its applications – Physical, Chemical and Biological properties of Vermicompost.

**UNIT III** Requirements for vermicomposting – Maintenance of composting – Collection of vermicompost – Efficiency of vermicompost – General problems in production of vermicompost.

**UNIT IV** Benefits of vermicompost – Vermi – Composting of Agricultural and Urban Solid Wastes – Recycling of wastes through vermicomposting – Earthworms as Bioreactors.

**UNIT V** Small scale or indoor vermicomposting – Large scale or outdoor Vermicomposting. Effects of Vermicompost on Soil properties. Vermicompost – Quality and Economics. Prospect of Vermiculture for self employment.

**Reference:**

1. Edwards, C.A. and Loft, J.R. Biology of Earthworms, 3<sup>rd</sup> Edition, Chapman Publications, 1977.
2. NIIR Board, The complete Technology Book on Vermiculture and Vermicompost, 2006.
3. Sultan Ahmed Ismail. The Earthworm Others India Press, Mapura 403507, Goa, India 2005.

## **PART - I: PAPER - III BIOREMEDIATION**

**Course Code : 17 MPZO03**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

**Unit I :** Environmental contaminants and remediation technologies – Organic and Inorganic environmental pollutants - Soil and water quality parameters – Physical, chemical and biological remediation technologies – Phytotechnologies used for remediation of contaminated terrestrial and aquatic environment – Advantages and limitations of remediation technologies

**Unit II :** Microbes in waste management – characterization of soil and liquid waste – use of microbes in waste treatment – Thermophiles – Alkalophiles – Acidophiles – Halophiles – Psychrophiles – Treatment of solid wastes – Basics of remediation of surface soil and sludges

**Unit III :** Removal of specific pollutants – removal of nitrogen and phosphorus - removal of oil and grease – sources of heavy metal pollution – Microbial biosorption – mechanism of biosorption and bioaccumulation - use of bacteria and fungi in biosorption - microbial mechanisms for removal of metal ions

**Unit IV :** Bioremediation - Definition – Fundamental principles - Types – natural – In-situ and Ex-situ bioremediation – constraints and priorities – current market for bioremediation – bioremediation monitoring in the field – Applications and advantages of bioremediation –Xenobiotics - Biodegradation of xenobiotic – Bio-augmentation for bioremediation

**Unit V :** Phytoremediation – Definition – basic concept - phytoremediation of heavy metals – Mechanism and techniques – phytoremediation of heavy metals – phytoextraction – phytodegradation – phytovolatilization – phytostabilization – role of arbuscular mycorrhizal fungi in phytoremediation

### **Reference:**

1. Jogdand S.N 2000. Environmental Biotechnology (Industrial Pollution Management) – Himalaya Publishing House.
2. Martin Alexander 1999. Biodegradation and Bioremediation, Academic Press.

**PART - I: PAPER - III**  
**ENVIRONMENTAL BIOLOGY**

**Course Code : 17 MPZO03**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

**UNIT I**

Biotic factors- Animal relationship-Symbiosis, Commensalisms, Mutualism, Antagonism, Predation, Parasitism, and Competition- intra specific and inter specific competition. Ecosystem: Freshwater ecosystem-Pond & River ecosystem- Food chain-Food web- Trophic levels – Energy flow – Ecological pyramid of Biomass, Number and Energy.

**UNIT II**

Population – definition – Natality, Mortality, population fluctuation, dispersal, Age pyramid, population estimation, Population equilibrium, Regulation. Community ecology – types of Communities – Characteristics of community. Stratification – Ecotone – edge effect – Ecological niche – Ecological succession.

**UNIT III**

- a) Forest resources: Use and over exploitation , deforestation, timber, extraction – mining, dams & forests.
- b) Water resources: Use and over exploitation of ground water – Surface water – Conflicts over water. Dams – Benefits & Problems.
- c) Energy resources: Growing energy needs – Renewable and non- renewable energy sources – use of alternate energy sources.

**UNIT IV**

Pollution – types – Air and Water pollution – their biological effects and control., Sewage and Solid Waste disposal and management – Green house effects – Ozone layer and its significance, Global warming, Acid rain, Bio magnifications – Eutrophication.

**UNIT V**

Flood warning system.earthquakes, Droughts, Famines and Heat waves – Cyclones- Wild fires – Land Slides – Disaster Management Information System (DMIS) – A guideline for disaster management.

**Reference Books:**

1. Odum, E.P. Fundamentals of Ecology. W.B. Saunder's Co. Philadelphia.1971.
2. Sharma , P.D, Ecology and Environment vii edition, Rastogi Publication.2005.
3. CLARKE, G.L, Elements of ecology, John Wiley & Sons, New york, 1954.
4. Kendeigh, S.C, Animal Ecology, Prentice HALL.1961.

## ENVIRONMENTAL MICROBIOLOGY AND MICROBIAL TECHNIQUES

Course Code : 17 MPZO03

Hours/Week : 4

Credit : 4

Max Marks : 100

Internal Marks : 40

External Marks : 60

### UNIT-I

Characteristic features, structure, functions and harmful effects of Virus, Protozoa, Bacteria, Actinomycetes, Fungi, Algae and Nematodes. Microorganisms and their environment: Temperature, oxygen, desiccation, extreme cold, ionic effect, electricity and osmotic pressures.

### UNIT-II

Aquatic microbiology -factors that affect microbial growth – temperature – pressure – light – salinity - turbidity – pH -inorganic and organic constituents. Aquatic Microorganisms as bio-indicators in the environment and Probiotics.

### UNIT-III

Bacteriology of drinking water and domestic sewage -MPN techniques for total coliform; Faecal coliform (thermotolerant coliform) MPN test; Faecal Streptococci (FS). Bacteriology - Characteristics, classification, pathogenesis, pathology, diagnosis, treatment, prevention and control of diseases caused by Staphylococci, Streptococci, Bacillus, Clostridium, Corynebacterium, Escherichia, Salmonella, Shigella, Klebsiella, Proteus, Vibrio, Pseudomonas, Mycobacteria, Spirochaetes, Rickettsia and Multy Drug Resistant bacteria (MDR).

### UNIT-IV

Environmental antibiotics and synthetic antimicrobial agents (Aminoglycosides,  $\beta$  lactams, tetracyclines, ansamycins, macrolid antibiotics) Antifungal antibiotics, anti-tumor substances. Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolone antimicrobial agents. Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis). Bacterial resistance to antibiotics. Mode of action of bacterial killing by quinolinones. Bacterial resistance to quionolinones. Bioactive compounds from herbal plants.

### UNIT-V

Molecular methods such as PAGE, Denaturing Gradient Gel Electrophoresis(DGGE)-Temperature Gradient Gel Electrophoresis(TGGE) - Amplified rDNA Restriction analysis and Terminal Restriction Fragment Length Polymorphism(T-RFLP) in assessing microbial diversity - 16S rDNA sequencing , Ribosomal Database Project and Pyrosequencing Technology.

### References:

1. Patrick K. Jemba. Environmental Microbiology Principles and Applications.
2. P D Sharma- Environmental Microbiology.

3. Brock TD, Madigan MT, Martinko JM and Parker J (1994) *Biology of Microorganisms*, VII Ed., Prentice Hall, New Jersey, USA.
1. David Greenwood, Richard CD, Slack, John Forrest Peutherer. (1992) *Medical Microbiology*. 14th edition. ELBS with Churchill Livingstone.
5. Hugo WB and Russell AD. (1989) *Pharmaceutical Microbiology* IV edition. Blackwell Scientific Publication, Oxford.
6. Anathanarayanan. *Medical Microbiology*.
7. Raina M. Maier, Ian L. Pepper, Charles P. Gerba - *Science. Environmental Microbiology*
8. David C. Hooper, John S. Wolfson. *Quinolone antimicrobial agents – Edt. ASM* Washington DC.
9. Maria Csuros, Csaba Csuros. *Microbiological examination of water and wastewater*.
10. Joseph C Daniel (1999) *Environment Aspects of Microbiology*. 1<sup>st</sup> Edition, Bright Sun Publications, Chennai.
11. Madhan Chakkaravarthy, V. and Prabakar. K. 2013. *Enzymology and Enzyme Biotechnology (For UG & PG students of Biological Science)*. YAZYM Publications, Trichy . ISBN- 978-93-81521-27-4



## RADIATION AND ENVIRONMENT

Course Code : 17 MPZO03  
Hours/Week : 4  
Credit : 4

Max Marks : 100  
Internal Marks : 40  
External Marks: 60

### UNIT:I

Scope of Radiation Ecology – Sources of natural radiation: Terrestrial and cosmic sources.- Man made Radiation: Medical (occupational, diagnostic)-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: II

Radiation ecology of aquatic systems-Distribution in water, Sediment and Biota- Bio concentration and concentration factor –Bioaccumulation of Radionuclides (Po-210 and Pb-210) in aquatic organisms- Indicator organisms.

### UNIT:III

Radiation in terrestrial environment – Distribution of radioactive substances. in Land (Primordial radionuclides  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ ) Low Background Radiation Area (LBRA) and High Background Radiation Area (HBRA). (National and World levels)- Indoor Radon and health hazard.

Effect of radiation – Cellular Level – Organ system level – Genetic effects (aberration)- Radiation sickness – Syndrome- Cancer Induction –Dosimetric Study.

### UNIT: IV

Application in Agriculture and Industry: Genetic improvement of crop plant – Insect, Pest and Disease Management – Food Preservation –Radiation Sterilization of medical products- Radio isotopes in Non- Destructive Testing (NDT). Application in Health care: Diagnostic Techniques- Radioimmune Assay (RIA)- Radio Pharmaceuticals – Radiolabelled cells –Radio therapy- Endovascular Radiation Treatment – Radiation oncology.

### UNIT:V

Measurement of radiation in the environment: Alpha counter –Beta Counter and Scintillometer. Nuclear reactors – Nuclear energy Programme in India – Radiation Protection – Principles and practices- Radioactive waste-sources and Management.

1. Sha, V.C. Elements of Radiation Biology, Today's & Tomorrow's Printers & Publishers, New Delhi. 1985.
2. Merrill Eisenbud Environmental Radioactivity, Academic Press, California. 1997.
3. Rao, P.S. Guest Editor, Nuclear Agriculture and Biotechnology, IANCAS Bulletin 15 (1). 1999.
4. 9. Sharma, A.K. Guest Editor Preservation of Food by Ionising Radiation, IANCAS Bulletin, 14(1). 1998.

## RADIATION ECOLOGY

**Course Code : 17 MPZO03**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

### UNIT:I

Water as scarce Natural resource, need for Water Management, source of Water pollution, Water waste treatment – Physical, Chemical and Biological treatment processes, Environmental Impact Assessment(EIA).

### UNIT: II

Global Environmental Problems: Ozone depletion, UV Radiation, Green house effect and Acid rain, their Impact and biotechnological approaches for management. Air, Noise and Thermal Pollution –their causes, harmful effects and control.

### UNIT:III

Scope of Radiation Biology – Sources of natural radiation: Terrestrial and cosmic sources .Man made Radiation: Medical (occupational, diagnostic)-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).  
Biological effects of radiation –Cellular Level – Organ system level – Genetic effects (aberration)-Radiation sickness – Syndrome- Cancer Induction –Dosimetric Study.

### UNIT: IV

#### Application of Radio isotopes

Application in biology: Tracer Technology- Metabolic and Biochemical Pathways- Protein Synthesis –Auto Radiography  
Application in Agriculture and Industry: Genetic improvement of crop plant – Insect, Pest and Disease Management – Food Preservation –Radiation Sterilization of medical products- Radio isotopes in Non- Destructive Testing (NDT).

### UNIT:V

Application in Health care: Diagnostic Techniques- Radioimmune Assay (RIA)- Radio Pharmaceuticals – Radiolabelled cells –Radio therapy- Endovascular Radiation Treatment – Radiation oncology.  
Measurement of radiation in the environment –Alpha counter –Beta Counter and Scintillometer. Nuclear reactors – Nuclear energy Programme in India - Radioactive waste: sources and Management.

**Books for Reference:**

1. Sharma, B.K. Environmental Chemistry, Goel Publishing House, Meerut. 1990
2. Grosh, D.S. Biological Effects of Radiation, Blaisdell Publishing Co. 1965.
3. Bascq, Z.M. and Alexander, P. Fundamentals of Radiobiology. 1961.
4. Wolf, G. Isotopes in Biology, Academic Press, New York. 1964.
5. Use of Radioisotopes in Biology BRNS, BRIT-DAE, Mumbai. 1989
6. Rao, P.S. Guest Editor, Nuclear Agriculture and Biotechnology, IANCAS Bulletin 15 (1). 1999.
7. Sharma, A.K. Guest Editor Preservation of Food by Ionising Radiation, IANCAS Bulletin, 14(1). 1998.
8. Sood, D.D. Reddy, A.V.R. Iyer, S.R.K. Gangadharan, S and Gursharan Singh, Applications of Radioisotopes and Radiation in Industrial Development, NAARRIM, Mumbai. 1998.
9. Lele, R.D. Principles and Practice of Nuclear Medicine, Arnold-Heinemann, New Delhi. 1984.

## MOLECULAR TOXICOLOGY

Course Code : 17 MPZO03  
Hours/Week : 4  
Credit : 4

Max Marks : 100  
Internal Marks : 40  
External Marks: 60

**Unit – I:** General Principles of Toxicology: Introduction – Definition – Types - Scope of toxicology Toxicity tests: Dosage, dose response - Acute toxicity tests: Bioassay, LC<sub>50</sub> and LD<sub>50</sub>, Probit analysis and Significance. Chronic toxicity tests: Methods, Significance.

**UNIT-II :** *In-vitro* Toxicology- Introduction, importance, history of cell culture development - Different type of cell culture media - Different tissue culture techniques - including primary and secondary culture, continuous cell lines, suspension culture, organ culture etc.

**UNIT- III :** Apoptosis and cancer: Mechanism of apoptosis - proteins involved in apoptosis-Signaling pathways : types and their impact on apoptosis and oncogenesis - Significance of –Cyclins, PTEN, IGF NF- $\kappa$ , extracellular matrix signaling, hypoxia, angiogenesis related pathways.

**UNIT – IV :** Therapeutic Applications of Stem Cell: Fundamentals of Regenerative Medicine, Autologous and Allogenic Stem Cell Transplantation, HLA Typing, Stem Cell Banking and Research: Banking – Cryopreservation Techniques, Stem Cell Banking in India, Ethics and Regulatory Affairs; Research - National Guideline By ICMR, Recent Advances and Clinical Trials.

**UNIT – V :** Techniques used for purification and characterization of biomolecules: Centrifugation, Ultrafiltration, Chromatography, electrophoresis, spectrophotometry, GC-MS, LCMS, NMR, MALDI - TOF, X-ray crystallography, Principles of Microscopy – Fluorescent, Confocal, Inverted and Electron microscope. Staining techniques – Nuclear and Mitochondrial staining.

### REFERENCES

1. Freshney RI. 2005. *Culture of Animal Cells*. Wiley Liss.
2. Portner R. 2007. *Animal Cell Biotechnology*. Humana Press.
3. Klaus-Michael Depatin, Simone Fulda. 2008. Apoptosis and Cancer Therapy; WILEY-VCH
4. Verlag GmbH & Co. , New York.
5. Stem Cells: Scientific Progress and Future Research Directions, NIH Monograph, University Press of The Pacific, 2004.
6. Ian F. Tannock, Richard P. Hill. 1998. The Basic Science of Oncology; Third edition;
7. McGraw- Hill, New York.

## MOSQUITO CONTROL

Course Code : 17 MPZO03  
Hours/Week : 4  
Credit : 4

Max Marks : 100  
Internal Marks : 40  
External Marks : 60

### UNIT I

Scope of medical entomology, Classification of Arthropoda, Medical and public health importance – Types of vector – Medicinal vector and Biological vector – Biological, Mechanical or Passive and Accidental transmission – Classification of medically important Arthropods

### UNIT II

General classification, Taxonomy and Morphology of mosquito Life history of mosquito in general, Differences in various stages of *Anopheles*, *Aedes* and *Culex* - Biology, Life cycle and public health importance of *Anopheles*, *Aedes* and *Culex*.

### UNIT III

Methods of collection equipments – Hand picking, beating and sweeping, Aerial netting, trapping – Mosquito breeding sites, Preservation method and insecticides sprayer types – Spray technique, Indoor residual spraying, conditions for use and effectiveness, Criteria for selective application, Selection of insecticides.

### UNIT IV

Mosquito control – Need for mosquito control, Goals of mosquito control, Preventive control, Curative control, Chemical control, Biological control, Genetic control, Integrated control, Hormonal control and Environment control. Selection of target area, Insecticides, Requirements of equipments, Manpower and materials – Spray timing – Space spraying.

### UNIT V

Malaria survey and National Malaria Eradication Programme (N.M.E.P and N.M.C.P) National Malaria Control Programme (N.M.C.P) difference between (N.M.E.P and N.M.C.P) – Vector Control Strategies – Supervision, Process and Performance Indicator, Community Participation, Safe use of Pesticides, use of fogging as a Vector Control Measure, Thermal fogging. Insecticide formulations used under NVBDCP.

### Text Books.

1. B.K.Tyaki, 2003. Medical Entomology. Scientific Publishers (INDIA), Jodhpur.
2. M.M. Trigunayat. 2002. A manual of practical entomology, Scientific Publishers (INDIA), Jodhpur.
3. T.V.Sathe, A.T.Sathe and J.Mahendra, 2011. Mosquito borne diseases. Manglam Publishers & Distributors, Delhi -110053.

## CONSERVATION BIOLOGY

Course Code : 17 MPZO03  
Hours/Week : 4  
Credit : 4

Max Marks : 100  
Internal Marks : 40  
External Marks : 60

**UNIT: I - SYSTEMATIC BIOLOGY:** Taxonomy- Definition- Terms and History; Importance of Taxonomy- Species concept- Kinds of species. Zoological classification- Hierarchy of categories : Linear hierarchy, keys and higher taxonomy Zoological nomenclature- Molecular taxonomy- bar coding.

**UNIT: II - CONSERVATION BIOLOGY:** Introduction to Conservation Biology – Ethical issues of Conservation Biology - The origin of Conservation Biology. Biodiversity – Species diversity- Genetic Diversity- Ecosystem diversity –Population Genetics- Loss of biodiversity- importance of biodiversity – Ethical role of biodiversity – Threats to biodiversity. Economics of biodiversity conservation – sustainable utilization

**UNIT : III - CONSERVATION: TOOLS IN ANIMAL CONSERVATION:** Conservation Methods - In situ and Ex situ conservation of Indian animals (Case studies) - Population management -Project Tiger and Elephant - Captive breeding programme - peoples participation in conservation - Successes and failures of conservation actions in India (Case study) -Tools in Conservation: Interpretation of various data on wildlife – IUCN Redlist categories - GIS – Remote sensing - Landscape model – PVA and CAMP processes.

**UNIT IV - ANIMAL LAWS AND POLICIES IN INDIA; ECONOMICS OF BIODIVERSITY CONSERVATION:** Wildlife (Protection) Act of India (1972) - Protected Area network - forest policy – Prevention of cruelty to Animal Act - Convention on Biological diversity, International Trade in endangered species - Zoo policy- Laws and their applications in Zoological parks, wildlife sanctuaries and biosphere reserves - Wildlife management and Animal welfare- Role of NGO's in Conservation.

**UNIT V - TECHNIQUES IN CONSERVATION BIOLOGY:** Ecological census - Basic Techniques – Shannon Weiner index to measure diversity of Animal species – Plotless sampling – Population indices - Sampling methods for Invertebrates- Amphibians - Reptiles - Fishes - Birds - Mammals - Environmental variables.

### References :

1. Anon. 1997. Wildlife (Protection) Act of India, Nataraj Publishers, Dehradun
2. IUCN, The World Conservation Union. <http://www.iucn.org/>.

**PART - I: PAPER - III**  
**ECOBIO TECHNOLOGY**

**Course Code : 17 MPZO03**  
**Hours/Week : 4**  
**Credit : 4**

**Max Marks : 100**  
**Internal Marks : 40**  
**External Marks : 60**

**Objective :** To impart knowledge on ecology and the potential benefits of Environmental biotechnology to humans and mitigate a few Environmental problems. Also to understand the various application of Environmental biotechnology in Industries and Agriculture

**Unit 1 :** Limiting factors, energy transfer and biogeochemical cycling in ecological systems; Response of microbes, plant and animals to environmental stresses; Concept of ecosystems and ecosystem management, Environmental problems- ozone depletion, green house effect, water, air and soil pollution, land degradation.

**Unit 2 :** GEMs in environment; Role of environmental biotechnology in management of environmental problems, Bioremediation, advantages and disadvantages; In situ and ex-situ bioremediation; slurry bioremediation; Bioremediation of contaminated ground water and phytoremediation of soil metals; microbiology of degradation of xenobiotics

**Unit 3 :** Physical unit operations, Chemical unit operations, Fundamentals of biological treatment, Role of biotechnology in water purification systems. Sewage and waste water treatment and solid waste management, chemical measure of water pollution, conventional biological treatment, role of microphyte and macrophytes in water treatment; Recent approaches to biological waste water treatment, composting process and techniques, use of composted materials.

**Unit 4 :** Biofuels and biological control of air pollution, plant derived fuels, biogas, landfill gas, bioethanol, biohydrogen; use of biological techniques in controlling air pollution; Removal of chlorinated hydrocarbons from air. Bioremediation-Biotechnology for clean environment, Biomaterials as substitutes for non-degradable materials, , Biosorption, molecular mechanisms of heavy metal tolerance.

**Unit-5 :** Status and Scope of Biotechnology in Environmental protection. Nonconventional energy sources. Environment protection Act: Environmental laws, Environmental policies, Environmental ethics. UN declaration. Environmental protection and conservation. Environmental Impact Assessment, Ecoplanning and Sustainable Development, Bioremediation- Biotechnology for clean environment. Bioindicators and biosensors for detection of pollution.

**Books**

1. Amann, R.I. Stromley, J. Stahl : Applied & Environmental Microbiology
2. Dash : Concepts of Ecology
3. Chattergy : Environmental Biotechnology
4. Varma & Agarwal : Environmental Biology
5. B.K. Sharma : Environmental Chemistry
6. Peavy & Rowe : Environmental Pollution
7. Asthana & Asthana : Environment Problems & Solutions
8. R.C Dubey , A text Book of Biotechnology
9. B. D. Singh, Bio Technology – Expanding Horizons
10. U. Satyanarayana, Biotechnology
11. H.K.Das , A text Book of Biotechnology



## SEMESTER I: CORE IV

### TEACHING AND LEARNING METHODOLOGY

**Course Code : 17MPZO1C4**

**Hours/Week : 4**

**Credit : 4**

**Max Marks : 100**

**Internal Marks : 40**

**External Marks : 60**

**Objective:**

To analyze and improve the intricacies of teaching and learning methods.

**UNIT-I: Computer Applications Skills:** Computer system: Characteristics, parts and their functions – Different generations of computer – Operation of computer: switching on/off/restart. Mouse control, Use key board and some functions of key – 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.

**UNIT-II: Communication Skills:** 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:** 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. Browsing Techniques, Website: Pub-med, Springer Link, Science directs.

**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 I 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 – Modes 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.

**List of Reference Books:**

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 Weert, UNESCO, 2002.
4. Kumar, K.L (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), Neelkammal Publications, Hyderabad.
9. Singh, V.K and Sudarshan, K.N (1996). Computer Education, Discovery Publishing Company, New York.
10. Sharme, R.A (2006). Fundamentals of Educational Technology, Surya Publications, Meerut.
11. Vanaja, M and Rajasekar, S (2006). Computer Education, Neelkamal Publications, Hyderabad.