PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

On obtaining a postgraduate degree the students will be able to:

PEO1 Display higher order thinking in the knowledge domain and demonstrate professional skills

PEO2 Contribute to the advancement and application of relevant knowledge by self-directed learning

PEO3 Extend and integrate knowledge and skills to design and develop novel products and explore innovative solutions to national and international goals of development.

PEO4 Exercise management skills and develop social interactions in a responsive, ethical and constructive way to meet global standards of excellence in all spheres of activity.

PEO5 Strive for social and economic equity based on the need for gender parity and ecological sustainability.

PROGRAMME OUTCOMES (PO)

PO1 – To acquire advanced conceptual knowledge and comprehensive understanding of the fundamental principle in the respective disciplines.

PO2 – To apply knowledge and critically evaluate the concepts and scientific developments to take up any challenge.

PO3 - To visualize and work on laboratory multidisciplinary tasks related to current research in the fields of Mathematical, Physical and Life sciences

PO4 – To acquire research based knowledge and design methods to conduct investigations of complex problems in research/ Industrial field and achieve employability / self employment.

PO5- To communicate effectively ideas verbally in English, leading to Entrepreneurship ventures such as consultancy and training.

PO6- Employ innovative and environment friendly methods, novel ideas to solve complex and challenging societal and environmental issues.

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO1 - To enhance the knowledge in advanced areas of research viz., biophysics, biostatistics, thesis writing and teaching methodologies.

PSO2 - A deeper understanding of key concepts in biology at cellular, genetic, biochemical, physiological and molecular level.

PSO3 - Students gain indepth understanding in the genetics of cancer biology and the current trends in cancer treatment.

PSO4 -To promote the use of bioinformatic tools in biotechnology and biodiversity studies.

PSO5 - To develop scientific approach and problem solving skills.

PSO6 -Update the modern trends in biological research and help to seek job opportunities world wide.

Course Profile

Sl.No.	Title of the Paper	Core/Elective	Credits
1.	Paper-I: Research Methodology	Core	5
2.	Paper –II: Recent Advances in Zoology	Core	5
3.	Paper-III	Elective	5
	1. Cancer Biology		
	2. Perspectives in Applied Zoology		
4.	Dissertation		21
Total credits			**36**

M.Phil., Zoology (2021 Onwards)

Course Profile

CORE	TITLE OF PAPER	PAPER CODE
PAPER -I	RESEARCH METHODOLOGY	5M21/CRM
PAPER-II	RECENT ADVANCES IN ZOOLOGY	5M21/CRA
ELECTIVE		
PAPER-III	CANCER BIOLOGY	5M21/ECB
PAPER III	PERSPECTIVES IN APPLIED ZOOLOGY	5M21/EPZ
	DISSERTATION	5M21/PRO

EVALUATION PROFILE

Code	Test		Assignment		Participation Seminar		Total	End Semester	Total
	No	Mark	No	Mark	No	Mark			
5M21/CRM	2	20	2	10	2	10	40	60	100
5M21/CRA	2	20	2	10	2	10	40	60	100
5M21/ECB OR 5M21/EPZ	2	20	2	10	2	10	40	60	100

Dissertation and Viva-Voce

Valuation Pattern

PATTERN OF ASSESMENT	MARKS
Internal Assessment (Guide)-CA	50
Dissertation (Internal and External)	100
Viva- Voce (Internal and External)	50
Total	200

Research Methodology

CORE PAPER -1 **COURSE CODE: 5M21/CRM**

CREDITS : 5

COURSE OBJECTIVES

1. To ascertain writing a thesis and a scientific paper.
2. To apply clinical laboratory techniques in the assessment of biological samples .
3. To prepare a project proposal.
4. To expand the knowledge to formulate a standard protocols in research work.
5. Identify the importance in industry for higher gain and productivity and to improve the quality of products.

COURSE OUTLINE

UNIT I

Research - Meaning, objectives, Types, Importance and Methods in Biological Sciences. Tenets of writing a thesis and a scientific paper: preparation of thesis and manuscript for publication. Citing of references, foot notes, Figures, Plates, Proof reading.

UNIT II

Principles of bio-physical methods for bio-polymer structure, determination of X-ray diffraction, fluorescence, UV, IR Spectroscopy and charge Determination using Zeta Analyser, ORD/CD Visible, NMR and ESR Spectroscopy, hydrodynamics method, atomic absorption and plasma emission spectroscopy.

UNIT III

Principles and applications of tracer techniques in biology, radiation dosimetry, radioactive isotopes and half life of isotopes, autoradiography, Cerenkov radiation, Liquid scintillation spectrometry.

UNIT IV

Principles and practice of statistical methods in biological research, samples and population, basic statistics, average statistics of dispersion, coefficients of variation, standard error, confidence limits. Probability distribution (Bionomial, Poisson and normal test of statistical significance, simple correlation and regression, analysis of variance).

UNIT V

Teaching technology-Types-Objective based-Skill based-Teaching large group-lecture,seminar, symposium, panel discussion, team teaching-project, workshop. Teaching small groups-remedial teaching.

RECOMMENDED TEXTBOOKS:

S. No	**Title of the Book**	**Authors**	**Publishers**	**Year of Publication**
1	Research methodology a step by step guide for beginners	Ranjit Kumar	Ranjit kumar publishers	**1999**
2	Research Methodology: for Biological Sciences	N. Gurumani	MJP Publishers	2009

REFERENCE BOOKS:

S. No	Title of the Book	Authors	Publishers	Year of Publication
1.	Research methods in education	Louis Cohen, Lawrence Mansion and Keith Morrison	Rouledge	2011
2.	Writing the doctoral dissertation	Davis, GB and CA Parker	Barrons Educational	1997
3.	Methods in Molecular Biology – From Cell to Molecules	Kannan, S. M. Krishnan, R.Thirumurugan and S.Achiraman	UVN- Press	2012

4.	Authoring a Ph.D thesis: How to plan, draft, write and finish a doctoral dissertation	Duncary P	Palgrave Macmillan	2003
5.	Statistical methods	Snedecor GW and WG Cochran	Oxford and IBH publishing Co PVt. Ltd.	1978

JOURNALS:

https://ijrm.humanjournals.com/

https://www.eajournals.org/journals/international-journal-of-quantitative-and-qualitative-research-methods-ijqqrm/

E-LEARNING RESOURCES:

https://explorable.com/research-methodology

https://www.geophysik.uni-muenchen.de/~valerian/Scientific_Working/SRMTunit2.pdf

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5019873/

https://www.journalagent.com/tard/pdfs/TARD_44_4_212_218%5BA%5D.pdf

https://www.pearsonhighered.com/assets/samplechapter/0/2/0/5/0205701655.pdf

COURSE OUTCOMES:

CO	CO STATEMENT
CO 1	**Students will be able to** To outline the principles in structuring and preparing a thesis and manuscript.

CO 2	To apply qualitative and quantitative research methods.
CO 3	To explain the principles and applications of various techniques in biology .
CO 4	To compare the statistical methods in biological research.
CO 5	To practice the various teaching methodologies.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	2	2	2
CO4	2	2	2	2	2	2
CO5	2	2	2	2	2	2
AVERAGE	2	2.6	2.2	2	2	2

KEY: **S**TRONGLY CORELATED-3 **M**ODERATELY CORELATED-2 **W**EAKLY CORELATED-1 **N**O CORELATION-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Flipped Learning, Smart Class, OHP, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN-M.Phil*

Knowledge Level	Section	Word Limit	Marks	Total
K 3	A-5X8 marks	500	40	100
K4,K5	B-3/5x20 marks	1500	60	

Recent Advances in Zoology

Core paper –II **Course Code : 5M21/CRA**

Credits: 5

Objectives:

To enable the students

1. To understand the importance of enzymes in the physiological process.
2. To obtain knowledge in the field of Bioenergetics and biotechnology.
3. To learn the techniques involved in tissue culture both in plants and animals.
4. To appreciate the importance of signal transduction for cellular functioning.

UNIT – I

Enzymes Kinetics (negative and positive co-operatively) regulations of enzymatic activity, active sites Co-enzyme activator and inhibitors, Iso enzymes.

UNIT – II

Energy metabolism (concept of free energy) thermodynamic principles in biology, energy rich bond, Weak interactions, couple reactions and oxidative phosphorylation,, group transfers, biological energy transducers, Bioenergetics.

UNIT – III

Lysogeny and lytic cycle in bacteriophages, Bacterial transformation, host cell restriction, transduction, complementation, molecular recombination, DNA ligases, Topoisomerases, gyrases, methylases, nucleases, restriction endonucleases, plasmids, cosmids, bacteriophages and their use in gene cloning for DNA, libraries and genomic libraries.

UNIT – IV

Cell and tissue culture in plants and animals, primary culture, cell line, cell clone, callus culture, soma clonal variations, micro propagation, somatic embryogenesis, haploidy, protoplast fusion, somatic hybridization, hybrids, gene transfer by micro injection, trans genesis, allopheny, artificial seeds.

UNIT – V

Structure and organization of membrane glycol conjugates and proteins in membrane system, ion transduction Pase. Hormone mediated message transduction, adenyl nuclease protein kinase systems, neuro – transmitter, acetycholine system, model membranes and liposomes.

Reference books:

1.Ambika Shanmugam, 2002, Fundamental of Biochemistry for Medical Students.
2.Anna.C.Pai, Foundation Genetics, Mc Graw Hill Book Company
3.Burns.G.W, The Sciences of Genetics Mac Millan Publishing Co. New York.
4.Cooper, The Cell- A Moleculer Approach.
5.David Frifielder, Molecular Biology
6.Gardner, Principles of Genetics, 8th Edition, John Wiley and Son
7.Gerald Karp, Cell Biology, Mc Graw Hill.
8.Jain J.L, 1983, Fundamental of Biochemistry.
9.Lehninger,A.L,1970, Biochemistry,Worth Publishing Co.,New York.
10. Lodish,Berk,Zipursky, Matsudaria and Baltimore, Molecular Cell Biology, 4th Edition. W.H. Freeman and Company.
11. Lubert Stryer,1975, Biochemistry, Freeman and Co.
12. Martin,D.W,P.A. Mayer and V.W.Redwell 1983,Harper's Review of Biochemistry 19th Edition, Maruyen Asian Edition.
13. Purohit, Biotechnology.
14. R.W. and S.B.Primrose, 1994 Principles of gene manipulation. 5th Edition Blackwell, science.
15.Ursula Goodenough, Genetics, Saunders college Publishing.
16.Watson, Molecular Biology of the Gene.

Question paper template

Component	Nature of Question	Maximum Marks
Part A	Description- Contains 5 questions to be answered out of 8 given questions covering all units	5 x 8=40
Part B	Application/ Analysis/ Synthesis/ Evaluation- Contains 3 questions to be answered out of 5	3 x 20= 60

CANCER BIOLOGY

Elective - III **Course Code: 5M21/ECB**

Credits: 5

COURSE OBJECTIVES

1. Interpret the cell culture techniques involved in cultivation of cancer cells.
2. Appraise the genetic basis of cancer and explain the importance of RNAi and nanomedicine in tumor treatment.
3. Ascertain the cell signaling mechanism in a cancer cell.
4. Explain the importance of nanoscience in cancer treatment**.**

COURSE OUTLINE:

UNIT-1: CELL CULTURE TECHNIQUE

Preparation of media and chemicals for cultivation of cancer cells- preparation of antibiotics for culture maintenance- primary cell and secondary cell culture- gene transfer into cancer cells. Microscopic technique staining to test the cell viability,cytotoxicity,cancer progression, DNAdamage and over expression of oncogenes at protein level. Applications of PCR in cancer studies. Kinetics of cancer cell growth,cell culture based vaccines. Cancer proteomics and genomics.

UNIT-2: GENETIC BASIS OF CANCER

Oncogene and their types- tumour suppressor genes and their mode of action- molecular mechanism of oncogenesis. Role of gene mutation in cancer induction. Apoptosis and their classification. Role of anti-apoptosis in cancer suppression. Impact of p53, retinoblastoma, E2F3, cPLA2 and COX-2 in cancer studies. Current scenario of RNAi and nanomedicine technology in tumour treatment and drug development.

UNIT-3: CELL SIGNALLING IN CANCER

Cell lines MCF-7, HeLa, HepG2, A549 and ZR771. Signaling at cell surface, types of signaling pathways that control gene activity, etiology, epidemiology, diagnosis and treatment of breast, lung, colo-rectal, blood, endocrine cancers. Role of gene therapy in cancer treatment. Significance of cancer stem cells.

UNIT-4: CURRENT TRENDS IN CANCER TREATMENT

Biocompatibility, bioaccumulation and controlled release properties of nano conjugates and nanocarrier. Nanoparticle as drug carriers- nanoparticles as gene carrier- nanoparticle as RNAi carriers. Development of nanomedicine to target cancer cells. Commercialized nanocarriers for cancer treatment. Impact of nano science in cancer biology.

REFERENCE BOOKS:

S. No	Title of the Book	Authors	Publishers	Year of Publication
1.	Essential cell biology	Albert B.et al.,	Garland Publishing. Inc. New York.	2008.,
2.	Genes XI,	Lewin , B.	Oxford University Press,	2009
3.	Genomes	Brown , T. A.	John Willey and Sons, Pvt. Ltd.,	2009
4.	Introduction to nanoscale science and technology	David J.Lockwood	National research council of Canada Ottawa,Ontario,	2004.
5.	Nanomaterials Handbook,	Yury Gogotsi	Taylor and Francis Group, Boca Raton, London.	2006.

JOURNALS:

1. Journal of immunotherapy of cancer.
2. Molecular cancer

E-LEARNING RESOURCES:

1. **http://www.ncbi.nlm.gov.**
2. **http://www.sciencedirect.com>topics**
3. **http://www.thermofisher.com**

4. http://www.progressreport.cancer.gov

COURSE OUTCOMES:

CO	CO STATEMENT
CO 1	**Students will be able to** Prepare and use the culture media for maintenance of cancer cells.
CO 2	Explain the oncogenesis and their molecular mechanism in Oncogenesis, and ascertain the impact of p53, retinoblastoma, E2F3, cPLA2 and COX- 2 in cancer studies.
CO 3	Outline the signaling pathways that control gene activity in the cancer cell.
CO 4	Create nano particles that could be used in cancer treatment.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
AVERAGE	3	3	3	3	3	3

KEY: **S**TRONGLY CORELATED-3 **M**ODERATELY CORELATED-2 **W**EAKLY CORELATED-1 **N**O CORELATION-0

QUESTION PAPER PATTERN-M.Phil*

Knowledge Level	Section	Word Limit	Marks	Total
K 3	**A-5X8 marks**	**500**	**40**	**100**
K4,K5	**B-3/5x20 marks**	**1500**	**60**	

Perspectives in Applied Zoology

Elective - III **Course Code : 5M21/EPZ**

Credits: 5

COURSE OBJECTIVES

1. Explain the techniques involved in aquaculture practices.
2. To identify issues related to biodiversity conservation.
3. To train the students in handling the tools in bioinformatics.
4. To ascertain the techniques of gene cloning.
5. To define and explain the rearing, instinctive and reproductive behavior in animal.

COURSE OUTLINE

UNIT-I

Application of biometrics in fisheries- Formulated feeds and live feeds- fish parasites and disease- culture techniques in aquaculture- water quality parameters in fish farm.

UNIT- II

Biodiversity definition- types- ecosystem diversity- hotspots of India- threats to biodiversity- habitat loss- man- wild life conflicts- endangered and endemic species of India- conservation of biodiversity.

UNIT-III

Bioinformatics- applications in biology- genomics- retrieval of potential genes- gene products- proteomics- retrieval of protein sequence.

UNIT-IV

Biotechnology- isolation of chromosomal DNA, plasmids and bacteriophage DNA- cloning studies in microorganisms, plants, animals and cell lines.

UNIT-V

Animal behavior- learning- instincts- reproductive behavior in animals.

REFERENCE BOOKS:

S. No	Title of the Book	Authors	Publishers	Year of Publication
1.	Gene cloning and DNA analysis, An Introduction 6th ed	Brown, T.A	Wiley	2010
2.	Fish and Fisheries of India	Jhingran,C.G	Hindustan publishing co.,	2009
3.	Bioinformatics III	Andreas D. Baxevanis	Wiley, John and Sons	2004
4.	Comparative animal physiology	Prosser, C.L	W.B. Saunders Co.	1973

JOURNALS:

1. Journal of fish biology.
2. Journal of fisheries research.
3. Journal of fisheries and livestock production.

E-LEARNING RESOURCES:

1. **http://www.springer.com**
2. **http://www.ncbi.nlm.nih.gov**
3. **http://www.researchgate.net**
4. **http://www.mastersportal.com**

COURSE OUTCOMES:

CO	CO STATEMENT
CO 1	Students will be able to Formulate fish feeds and plan procedure for fish culture.
CO 2	Evaluate and asses the procedures involved in biodiversity conservation.

CO 3	Utilize genomics and proteomics in the field of research.
CO 4	Demonstrate the techniques involved in gene cloning.
CO 5	Outline the behavioral pattern in animals pertaining to rearing, instinct and behaviour.

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
AVERAGE	3	3	3	3	3	3

KEY: **S**TRONGLY CORELATED-3 **M**ODERATELY CORELATED-2 **W**EAKLY CORELATED-1 **N**O CORELATION-0

TEACHING METHODOLOGY:

Lecture by chalk and talk, Flipped Learning, Smart Class, OHP, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar.

QUESTION PAPER PATTERN-M.Phil*

Knowledge Level	Section	Word Limit	Marks	Total
K 3	**A-5X8 marks**	**500**	**40**	**100**
K4,K5	**B-3/5x20 marks**	**1500**	**60**	