



RIMT
UNIVERSITY

Program name: Master of Zoology
Program Code: ZOO 401

RIMT UNIVERSITY
MANDI GOBINDGARH,
PUNJAB



RIMT
UNIVERSITY

Study Scheme & Syllabus

As per Choice Based Credit

System (CBCS)

For

M. Sc Zoology
(First to Four Semester)

ProgramCode: MZOO401

(W.e.f. Session 2021-22)



Program name: Master of Zoology
Program Code: ZOO 401

SCHOOL OF BIOSCIENCES

RIMT UNIVERSITY MANDI GOBINDGARH, PUNJAB

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SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places and a centre of excellence to promote and nurture future leaders who would facilitate the desired change in the society.

MISSION

- To impart teaching and learning through cutting-edge technologies supported by the world class infrastructure
- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values.



SECTION 2

Vision and Mission of the Department

DEPARTMENT OF LIFE SCIENCES

VISION

Science is all about sense and sensibility of life. Modern science and technology have changed our life in many ways. Aeroplanes, automobiles, communications satellites, computers, plastics, and television are few of the scientific and technological inventions that have transformed human life and the ideas behind all these ubiquitous technologies come from basic sciences.

- School is committed to innovation and excellence in teaching and research and preparing the students to be successful in science-related careers that are essential for meeting global needs.
- School advances knowledge through multidisciplinary education and research in all streams of basic sciences viz; Microbiology, Botany and Zoology.
- The M.Sc. programmes are mainly focused on multi-disciplinary research based teaching with emphasis on dissertations.
- Each student is given perfect hands on training on current techniques in basic sciences.

Mission

- To transform education through academic excellence in sciences, providing analytical and application oriented teaching, innovative and world class pedagogy, nurture professionals who, with their commitment and integrity, can make a difference in their respective profession and in turn transform the society.
- Department of Life Sciences in School of Biosciences in RIMT University disseminating the knowledge in the field of Life Sciences through teaching & learning process.
- It offers various graduates, post graduate and doctorate courses in field of Zoology, Botany and Microbiology.



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- The Department is well equipped with teaching and research laboratories. For Life Science students, most of the opportunities are found in universities and research institutions. There are a large number of research institutions under the Council of scientific and industrial research.
- Students can opt the option of CSIR NET exam; it will give a great career scope in research. Lifesciences students can go for various Pharmaceuticals by opting Masters with one of the clinical subject.
- The knowledge of plant sciences is essential for development and management of forests, parks, waste lands etc.
- Few of the industries which can work with are: Forest Services, Biotechnology Firms, Land Management Agencies, Food companies, Seed & Nursery companies, National Parks, Plant Resource Laboratories, Plant health inspection services, Arboretum, Chemical industries, Educational institutes, Biological supply houses.
- The field of Microbiology has immense scope, due to advancement of field of science and technology, and in many areas like medicine, pharmacy, dairy industry, clinical research, water industry, agriculture, chemical technology and nanotechnology.
- For higher studies also, students can go for various doctorate fellowships and Post doctorate fellowships for higher education in India and abroad as well.

SECTION 3

About the Program

This M.Sc. Zoology Program is an Outcome Based Education model which is a 2 year, 4 Semester Full time Program of **90** * credit hours that will be based on Choice Based Credit System (CBCS) and Grading Evaluation System. This program comprises of foundational courses, core courses, specialization electives courses, enrichment courses and experimental learning. The suggestive curriculum takes the M.Sc. Zoology program to the next level in terms of implementing Outcome Based Education and to develop professionals who are knowledgeable in their chosen domain, responsive to the living system-environment interface, ethical in all doings and with a global outlook and approach.

These objectives shall be achieved through a very rigorous academic processes, updated and relevant curriculum, extensive industry interaction and collaborations, sports and vibrant student activities.



SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

M.Sc. Zoology PROGRAM

PROGRAM EDUCATION OBJECTIVES

PEO-1:	To understand the diverse fields of Zoology.
PEO-2:	To be acquainted with the value of fauna and its significance for the society.
PEO-3:	To develop problem solving skills in students to make them carry out innovative research projects.
PEO-4:	To provide highly skilled professionals to the society.

Program outcomes (PO)

PO:1: Develop deeper understanding of key concepts of biology and different biological systems.

PO:2: Apply the knowledge attained in research field to make new discoveries. Learn scientific experiment designing and equipment handling skills.

PO:3: Employ highly developed conceptual, analytical, quantitative and technical skills.

PO:4: Compare and contrasts characteristics of different forms of Life.

PO:5: Understand evolutionary processes and relationships. Learn to analyze evolutionary parameters using various bioinformatics and computational tools used in modern sciences.

PO:6: Understand the importance of biodiversity, ecological factors, threats and biodiversity conservation strategies.

PO:7: Knowledge of developmental pathways and classical genetics in order to understand distribution and inheritance of different traits and diseases among populations and correlate with modern techniques like genomics, metagenomics, genome editing and molecular diagnostic tools.

PO:8: Understand the key concepts of Life Sciences at ecological, developmental, molecular,



cellular, biochemical, physiological and behavioral level.

PO:9: Explore knowledge of applied fields like conservationist, entomologist, ecologist, curator, conservation biologist, lab technologists, sericulture, apiculture, fisheries, poultry, vermiculture, dairy farms etc.

PO:10: The program enhances scientific temper and creativity, which will be helpful for the society since scientific developments can make a nation to grow at a rapid pace.

Program Specific Outcomes (PSO)

PSO:1: Identify, classify and differentiate diverse forms of life based on their morphological, anatomical and systemic organization.

PSO:2: Define and explain major concepts in the biological sciences. Learn practical skills in biotechnology, biostatistics, bioinformatics, biosystematics, biochemistry, developmental biology, human physiology, cell biology, cytogenetics and molecular biology. Acquire complete knowledge of disciplinary as well as allied biological sciences. Ability to connect and apply gained biological knowledge to other disciplines.

PSO:3: Understand and evaluate animal interactions with the environment. Evaluate the mechanisms of ecology, ethology, systematic and evolution in the natural world.

PSO:4: The students will be well equipped to become very competent in research or teaching fields after completion of this course. Students can apply the knowledge of core concepts of zoology in competitive examinations like joint CSIR UGC NET, SET, GATE, ICAR, ICMR Civil Services examinations like Indian Forest Service or State Government Forest Services, and other government services in departments of environment, wildlife, forests, Zoological survey, forensics etc. He/She can join as Scientist/Assistant professor/Teaching assistant or can prepare for Indian Civil Services (Indian Forest Service). Students can join industries or may opt for establishing their own industrial unit. Practical and theoretical skills gained in this program will be helpful in designing different public health strategies for social welfare.



SECTION 5

Curriculum / Scheme with Examination Grading Scheme

SEMESTER WISE SUMMARY OF THE PROGRAMME: M.Sc. Zoology

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	30	800	24
2.	II	30	800	24
3.	III	27	700	21
4.	IV	27	700	21
	TOTAL	114	3000	90

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A+	9	Excellent
60-69	A	8	Very Good
55-59	B+	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Pass
0-39	F	3	Fail
AB			Absent

Percentage Calculation: CGPA *10



Study Scheme & Detailed Syllabus applicable 2021 onwards

M. Sc. Zoology
Semester-I

Sr. No.	Subject Name	Mode	Code	L	T	P	Cr	Internal	External	Total
1	Biosystematics & Taxonomy	Theory	MZ00-1101	3			3	40	60	100
2	Molecular Biology	Theory	MZ00-1102	3			3	40	60	100
3	Evolutionary Biology	Theory	MZ00-1103	3			3	40	60	100
4	Developmental Biology	Theory	MZ00-1104	3			3	40	60	100
5	Insect & Environment	Theory	MZ00-1105	3			3	40	60	100
6	Microbiology	Theory	MZ00-1106	3			3	40	60	100
7	Practical Paper I (Biosystematics & Taxonomy, Molecular Biology and Evolutionary Biology)	Practical	MZ00-1107			6	3	0	100	100
8	Practical Paper II (Developmental Biology, Insect & Environment and Microbiology)	Practical	MZ00-1108			6	3	0	100	100
	Total						24	240	560	800

L-- Lecture
T-- Tutorial
P---Practical



M. Sc. Zoology
Semester-II

Sr. No.	Subject Name	Mode	Code	L	T	P	Cr	Internal	External	Total
1	Cytogenetics & population genetics	Theory	MZ00-1201	3			3	40	60	100
2	Ecology and Limnology	Theory	MZ00-1202	3			3	40	60	100
3	General Physiology	Theory	MZ00-1203	3			3	40	60	100
4	Biochemistry	Theory	MZ00-1204	3			3	40	60	100
5	Research Methodology	Theory	MZ00-1205	3			3	40	60	100
6	General Immunology	Theory	MZ00-1206	3			3	40	60	100
7	Practical Paper I (Cytogenetics & population genetics, Ecology & Limnology & General Physiology)	Practical	MZ00-1207			6	3	0	100	100
8	Practical Paper II (Biochemistry, Research Methodology and General Immunology)	Practical	MZ00-1208			6	3	0	100	100
	Total						24	240	560	800

L-- Lecture
T-- Tutorial
P---Practical



M. Sc. Zoology
Semester-III

Sr. No.	Subject Name	Mode	Code	L	T	P	Cr	Internal	External	Total
1	Animal Behaviour	Theory	MZ00-2301	3			3	40	60	100
2	General Endocrinology	Theory	MZ00-2302	3			3	40	60	100
3	Bio analytical & Statistical Techniques	Theory	MZ00-2303	3			3	40	60	100
4	SPCL I (Insect Morphology & Applied Entomology)#	Theory	MZ00-2304	3			3	40	60	100
5	SPCL I (Insect Anatomy & Toxicology)#	Theory	MZ00-2305	3			3	40	60	100
6	SPCL II (Fish & Fisheries)*	Theory	MZ00-2306	3			3	40	60	100
7	SPCL II (Fish Production Technology)*	Theory	MZ00-2307	3			3	40	60	100
8	Practical Paper I (Animal Behaviour, General Endocrinology and Bioanalytical & Statistical Techniques)	Practical	MZ00-2308			6	3	0	100	100
9	Practical Paper II (SPCL I or SPCL II)	Practical	MZ00-2309			6	3	0	100	100
	Total						21	280	620	700

For students who opted SPCL I as specialization.

* For students who opted SPCL II as specialization.

L-- Lecture

T-- Tutorial

P---Practical



M. Sc. Zoology
Semester-IV

Sr. No.	Subject Name	Mode	Code	L	T	P	Cr	Internal	External	Total
1	Industrial Zoology	Theory	MZ00-2401	3			3	40	60	100
2	Wild life & its management	Theory	MZ00-2402	3			3	40	60	100
3	Zoogeography & Evolution	Theory	MZ00-2403	3			3	40	60	100
4	Parasitology	Theory	MZ00-2404	3			3	40	60	100
5	Recent Advances in Entomology (SPCL I) / *Fish & Fisheries (SPCL II)	Theory	MZ00-2407	3			3	40	60	100
6	Practical Paper I (Industrial Zoology and Wild life & its management, Zoogeography & Evolution and Parasitology)	Practical	MZ00-2405			6	3		100	100
7	Practical Paper II -(Recent Advances in Entomology (SPCL I) / *Fish & Fisheries (SPCL II)	Practical	MZ00-2406			6	3	0	100	100
	Total						21	200	500	700

L-- Lecture
T-- Tutorial
P--Practical



SECTION 6

Detailed Syllabus with Course Outcomes

Detailed Syllabus

SUBJECT TITLE: Biosystematics & Taxonomy

SUBJECT CODE: MZOO-1101

SEMESTER: I

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Course Objectives:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Biosystematics and Taxonomy
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Definition and basic concepts of biosystematics and taxonomy 1.1 Historical resume of systematics. 1.2 Importance and applications of biosystematics in biology. 2. Trends in biosystematics- concepts of different conventional and newer aspects. 2.1 Chemotaxonomy 2.2 Cytotaxonomy 2.3 Molecular taxonomy. 2.4 Ecotaxonomy 2.5 Behavioural taxonomy.	15
UNIT-II	3. Species concepts – species category, different species concepts; sub-species and other infra-specific Categories.	15



	3.1 Biological Species Concepts, its merits & demerits. 3.2 Typological species. 3.3 Nominalistic Species Concept. 3.4 Evolutionary Species Concept.	
UNIT-III	4.Taxonomic characters-details account of different kinds 5.Procedure in taxonomy 5.1 Taxonomic procedures-taxonomic collections, preservation, curation, process of Identification. 5.2 Taxonomic keys-different kinds of taxonomic keys, their merits and demerits. 5.3 Systematic publications-different kinds of publications.	9
UNIT-IV	6 Sustainable utilization of Biodiversity 6.1 conservation of Biodiversity and laws 6.2 Genetic and non genetic Variations 6.3 Equitable sharing of benefits of biodiversity to device for sustainable management	6

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: An in-depth knowledge on classical and modern methods employed in systematics.

CO2: Methods for the construction of taxonomic keys and phylogenetic trees.

CO3: Methods of taxonomic collections, preservations, curation and process of identification.

CO4: Biodiversity conservation strategies.

Recommended Books:

1. Biodiversity by V.C. Kapoor
2. M. Kato (2012) The Biology of Biodiversity, Springer.
3. E.O. Wilson (1988) Biodiversity, Academic Press, Washington.
4. E. Mayr. (1998) Elements of Taxonomy.
5. E.O. Wilson. The diversity of Life (The College Edition), W.W. Northern & Co.
6. Simpson , G.G (2012).Principles of Animal Taxonomy Scientific Publishers, Jodhpur.
7. Verma , A.(2015), Principles of Animal taxonomy , Narasa Publishing House Pvt.Ltd, New Delhi.

Instruction of Question Paper setter

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Molecular Biology

SUBJECT CODE: MZOO-1102

SEMESTER: I

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Molecular Biology
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching and research.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Historical development of molecular biology, nucleic acids as genetic material, chemistry and structure of DNA and RNA. 2. DNA replications, DNA repair, recombination, reverse transcriptase, repetitive and non-repetitive DNA, satellite DNA. 3. Transcription in prokaryotes and eukaryotes process, RNA editing, RNA processing.	15
UNIT-II	1. Genetic code, ribosome structure and function, aminoacyl t-RNA synthases. 2. Translation and post translational modification; protein targeting, nucleases and restriction enzymes, regulation of gene expression in prokaryotes and eukaryotes, molecular mechanism of mutation.	15
UNIT-III	1. Applications of antisense, ribozyme and r-DNA technology. 2. DNA sequencing, recombinant DNA technology, different types of vectors, genomic and cDNA library, selection of recombinants, PCR.	9
UNIT-IV	1. Application of recombinant DNA technology. 2. Gene therapy, DNA fingerprinting (Paternity and Forensics)	6



Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Structure of DNA and RNA.

CO2: Mechanisms of replication, transcription, translation, repair mechanism in Prokaryotes and Eukaryotes.
Post transcriptional and post translational modifications.

CO3: Application of DNA technology and molecular biology for research.

CO4: Better understanding of modern DNA technology for disease diagnostics and therapy.

Recommended Books:

1. Mayers R.A. (1995) Molecular Biology and Biotechnology, A comprehensive desk reference (Ed) VCH Pub. Inc. New York.
2. Brown T.A. (2006) Molecular Biology, Bios Scientific Pub. Ltd. Oxford.
3. Walker and Ginglod (1992) Molecular Biology & Biotechnology, Royal Society of Chemistry Cambridge.
4. Gardener, Simmons and Snustad (1991) Principles of Genetics. Wiley & Sons. Inc. New York.
5. Singh, B.D. (2016) Fundamentals of Genetics. Kalyani Publishers.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus



SUBJECT TITLE: Evolutionary Biology

SUBJECT CODE: MZOO-1103

SEMESTER: I

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of the process of evolution.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to understand biological evolution; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	Evolutionary Biology: 1.1 Importance of evolutionary biology 1.2 Structure of evolutionary biology 1.3 Major points of evolutionary synthesis and evolutionary biology since the synthesis 1.4 Brief idea regarding Darwin's contribution and evolution after Darwin	15
UNIT-II	Evolutionary Processes in Population and species 1.1 Significance of Hardy-Weinberg principle, factors in evolution 1.2 Evolution by genetic drift and relationship between inbreeding and genetic Drift 1.3 Natural selection, Strength of Natural Selection and its analysis in present pretext	10
UNIT-III	Speciation 1.1 Modes of Speciation: Allopatric and sympatric 1.2 Allopatric Speciation and alternatives to allopatric speciation 1.3 Role of polyploidy and Hybrid Speciation 1.4 Rates of Speciation and Consequences of speciation	5
UNIT-IV	Phylogeny 1.1 Phenetics and cladistics	15



	1.2	Phylogenetic Hypothesis	
	1.3	Molecular Data in Phylogenetic Analysis	
	1.4	Advancements in Phylogenetic Estimations	

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Detailed knowledge of theories of origin and extinction.

CO2: Thorough knowledge of different evolutionary forces that affect genetic structure.

CO3: Modes of Speciation.

CO4: Method of phylogenetic trees construction.

SUGGESTED READING MATERIAL

1. Futuyma, Douglas J. 2005. Evolutionary Biology (3rd edition) Sinauer Associates, Inc., Sunderland, Massachusetts
2. Avise, John C. 2004. Molecular Markers, Natural History and Evolution (2nd Edition) Sinauer Associates, Inc., Sunderland, Massachusetts
3. Coyne, Jerry A. and Orr, Allen H. 2004. Speciation Sinauer Associates, Inc., Sunderland, Massachusetts
4. Gould, Stephen Jay. 2002. The Structure of Evolutionary Theory. Harvard University Press, Cambridge, Massachusetts
5. Gould, Stephen Jay. 1997. Ever Since Darwin, Reflections in Natural History. W.W. Norton and company Net work
6. Freeman, S. and Harrison, C. Jon. 2006 Evolutionary Analysis (4th Edition) Prentice Hall, Inc. Pearson, NJ
7. Wen-Hsiung Li (1997), Molecular Evolution, Sinauer Associates Inc. Pub. USA.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus



SUBJECT TITLE: Developmental Biology

SUBJECT CODE: MZOO-1104

SEMESTER: I

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of biology of development of individuals.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1 Principles of Development in Biology 1.1 Developmental Patterns in Protists, Volvocaceans, Dictyostelium in relation to Metazoa 1.2 Cell Specification, Cell Adhesion 1.3 Adaptations of embryos and larvae to environment	15
UNIT-II	2 Environmental Regulation of Animal Development 2.1 Role of environment in development 2.2 Phenotypic Plasticity 2.3 Role of Tetratogens in development	10
UNIT-III	3 Cell-Cell Communication in Development 3.1 Induction and Competence 3.2 Paracrine factors 3.3 Signal Transduction and Cell Surface receptors	5
UNIT-IV	4 Metamorphosis: The hormonal reactivation of development 4.1 Amphibian metamorphosis: Morphological changes associated with metamorphosis. 4.2 Hormonal control of Amphibian metamorphosis. 4.3 Metamorphosis in insects: Types of insect metamorphosis 4.4 Hormonal control of insect metamorphosis	15

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Developmental patterns in protists, insects and amphibians.

CO2: Molecular and genetic background of developmental processes.

CO3: Signal transduction developmental pathways.

CO4: Effect of Teratogens on developmental pathways.

SUGGESTED READING MATERIAL

1. Gilbert, Scott F. 2006. Developmental Biology (8th Edition) Sinauer Associates, Inc., Sunderland, Massachusetts
2. Bard, J.B.L. 1990. Morphogenesis: The cellular and Molecular Processes of Developmental Anatomy. Cambridge University Press, Cambridge
3. Arthur, W. 1997. The Origin of Animal Body Plans: A study in Evolutionary Development Biology. Cambridge University Press, New York
4. Behe, M.J. 1996. Darwins Black Box: The Biochemical challenge to Evolution. Simon and Schuster, New York
5. Jangir, O.P. (2005). Developmental Biology. A manual. Agrobios (India)
6. Elder, K. and Dale, B.(2001). In vitro fertilization 2nd edition. Cambridge University Press, Cambridge.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Insect & Environment

SUBJECT CODE: MZOO-1105

SEMESTER: I

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam: 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of insects and environment.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, researchers as JRF, SRF etc.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Insects as manageable resource. 1.1 Apiculture 1.2 Lacture 1.3 Sericulture 2. Insects as biological control agents. 3. Insects as pollution indicator and insects as biological indicator 4. Insects as food to animals and humans	15
UNIT-II	5. Insects as scavengers. 6. Insects as pollinators. 7. Insects and their role in Pharmacy.	10
UNIT-III	8. Insects and their role in forensic investigations. 9. Insects as vectors of human pathogens.	5
UNIT-IV	10. Introduction to high altitude entomology. 11. Adaptations (Morphological, Ecological, Physiological) of Insects at high altitude. 12. Origin of endemism in Insects at high altitude.	15



Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Knowledge of economically important insects and their role in various fields like forensic entomology, food industry, and Integrated pest management.

CO2: Sericulture, Lac Culture and Apiculture.

CO3: Role of Insects in Pharmacy.

CO4: High altitude entomology.

SUGGESTED READING MATERIAL

1. Mani, M.S. Introduction to high altitude Entomology (1962). Methuen and Co. Ltd. 36 Essex street W.C. 2, London
2. Mani, M.S. Ecology and Biogeography of High altitude Insects (1968). Dr. W. Junk N.V. Publishers- the Hague.
3. Srivastava, K.P, Text Book of Applied Entomology Volume-II (2005).
4. Gullan, P.J. and Cranston, P. The Insects, an outline of Entomology, 3rd Edition (2005). Blackwell Publishing Ltd., USA.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Microbiology
SUBJECT CODE: MZOO-1106
SEMESTER: I
CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of the world of microbes.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. General Microbiology : 1.1 Characterization, Classification and Identification of micro-organisms. 1.2 Morphology and fine structure of bacteria 1.3 Reproduction in bacteria 2. Other Micro-organisms 2.1 Fungi 2.2 Algae 2.3 Protozoa 2.4 Viruses	15
UNIT-II	3. Microbial Physiology 3.1 Bioenergetics 3.2 Oxidation-reduction reactions. 3.3 Respiratory chain 3.4 Energy production 4. Microbial Genetics. 4.1 Organization of bacterial genome 4.2 Bacterial recombination 4.3 Transformation 4.4 Conjugation 4.5 Transduction	10
UNIT-III	5. Environmental Microbiology 5.1 Microbial flora of soil and their role in Nitrogen and Carbon	5



	transformation. 5.2 Aquatic micro-organisms and their importance. 5.3 Micro-organisms of domestic and waste water. 6. Food and Industrial microbiology. 5.4 Microbial flora of fresh food, spoilage and preservation of food. 5.5 Fermented foods. 5.6 Micro-organisms as food.	
UNIT-IV	7. Micro-organisms and Human health 5.1 Distribution of micro-organisms in healthy human body. 5.2 Microbial agents of diseases: bacteria, viruses and protozoa. 8. Control of microorganism by: 5.3 Physical agents 5.4 Chemical agents 5.5 Other therapeutic agents.	15

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Basic structure, function, characterization, classification and Identification of microorganisms.

CO2:Microbial Physiology & Microbial Genetics.

CO3:Understanding of Food, Industrial and Environmental Microbiology.

CO4:Microbial agents of diseases and their control.

SUGGESTED READING MATERIAL

1. General Microbiology by R.V. Stainer, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Mac Millan, Hong Kong, 1992.
2. General Microbiology by H.G. Schegel, Cambridge University, Press, U.K. 1995
3. Microbiology by Pelczar, M.J., Chan, C.S. and Krieg, D.R. McGraw-Hill offices, New York, 2000
4. Microbiology: Principles and Applications by Greager, J.G., Black, J.G. and Davision, V.E., Prentice Hall, New Jersey, 1990.
5. Principles of Microbiology by R.M. Atlas, Mosby, St. Louis, 1995.
6. Microbiology, A Human Perspective by E.W. Nester, C.E. Roberts, M.T. Nester, WCB Phis, London, 1995.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus



SUBJECT TITLE: Practical Paper-I

SUBJECT CODE: MZOO-1107

SEMESTER: I

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Duration of Exam; 3 Hrs

1. Techniques of collection and preservation with respect to insects and fishes,
2. To prepare identification keys of various animal groups
3. To study external morphological features of various animal groups (beaks & claws, scales of fishes, wing venation and external genitalia of insects).
4. Identification methods for insects, fishes, birds etc.
5. Study of course of meiosis in grasshopper
6. Study of polytene chromosomes of *Chironomous* larva.
7. Chromosome preparation by airdrying technique to study morphological details of monocentric chromosomes.
8. Chromosome preparation by air drying technique to study morphological details of holocentric chromosomes.
9. Study of organisms with reference to their evolutionary significance (adaptations, connecting links, modifications, missing links, living fossils, continuous and discontinuous distribution).
10. Phylogenetic analysis in context with phenetics and cladistics.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Method of collection of fishes & insects, their taxonomic features and preparation & use of taxonomic keys.

CO2:Slide preparation for study of chromosomes and its meiotic behavior. Differentiate between monocentric and holocentric chromosome and their meiosis.

CO3:Study of organisms with evolutionary significance.

CO4: Phylogenetic analysis using various tools.



SUBJECT TITLE: Practical Paper-II

SUBJECT CODE: MZOO-1108

SEMESTER: I

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Duration of Exam; 3 Hrs

1. To study life cycle of acellular slime mould.
2. To study life cycle of cellular slime mould.
3. To study the internal structure of Chick egg.
4. To study the external morphology of blow fly.
5. To study the development of chick embryo from permanent slides.
6. To study the development of frog embryo from permanent slides.
7. To study the life history of honey bee.
8. To study the life history of lac insect
9. To study the life history of silk worm (*Bombyx mori*).
10. To study the life history of *Musca domestica*
11. To study the life history *Culex* mosquito
12. To study the life history of *Anopheles* mosquito
13. To study the morphological features of honey bee
14. To study the different types of mouthparts in insects.
15. To study the genitalic features in insects.
16. Visit to apiary/vermicomposting unit and preparation of report of glassware used in microbiology laboratory and preparation of nutrient broth and nutrient agar.
17. Preparation of nutrient agar plates and swabbing to obtain colonies
18. Differential staining of given culture to identify gram positive and gram negative bacteria.
19. Perform hanging drop mount method to examine the motility of bacteria.
20. Determine the quality of given milk sample by using methylene blue test.
21. Determine the growth curve of given bacterial colony.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Developmental patterns of slime moulds, frog and chick.

CO2:Life history of important insects like honey bee, Lac insect, *Culex* and *Anopheles*.

CO3:Taxonomic features of insects and preparation & use of taxonomic keys.

CO4:Preparation of bacterial culture and study & interpretation of growth curve of bacterial colony.



SECOND SEMESTER

SUBJECT TITLE: Cytogenetics & Population Genetics

SUBJECT CODE: MZOO-1201

SEMESTER: II

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of cytogenetics and population genetics
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	<ol style="list-style-type: none">1. Biology of chromosomes.<ol style="list-style-type: none">1.1 Metaphase chromosomes, Centromere, Kinetochore, Telomere & its maintenance.1.2 Heterochromatin & Euchromatin.1.3 Giant chromosomes: Polytene & Lampbrush chromosomes.2. Sex determination.<ol style="list-style-type: none">2.1 Sex chromosomes & Sex determining mechanisms.2.2 Dosage compensation in <i>Drosophila C elegans</i> & Man.	15
UNIT-II	<ol style="list-style-type: none">1. Cytogenetic implications and consequences of<ol style="list-style-type: none">1.1 Structural changes.1.2 Numerical changes2. Molecular basis of Mutations and their role in evolution.<ol style="list-style-type: none">2.1 Spontaneous Mutations.2.2 Induced Mutations	10
UNIT-III	<ol style="list-style-type: none">1. Population genetics.<ol style="list-style-type: none">1.1 Hardy-Weinberg law and its application.1.2 Inbreeding, outbreeding and assortive mating.1.3 Changes in allelic frequencies.1.4 Genetic equilibrium.2. Evolutionary genetics.<ol style="list-style-type: none">2.1 The Synthetic theory of evolution.2.2 Adaptive evolution.	5



	2.3 Evolution of multigene families.	
UNIT-IV	. Somatic cell genetics. 1.1 Cell fusion, hybrid agents and mechanism of fusion. 1.2 Heterokaryon-selective hybrids and chromosome segregation. 2. Molecular genetic techniques. 2.1 FISH 2.2 CGH 2.3 Flow Cytometry. 2.4 Automated Karyotyping.	15

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Understanding of chromosome structure, functions and karyotypes.

CO2:Understanding of different types of structural and numerical chromosomal aberrations and their evolutionary consequences.

CO3:Modern cytogenetical techniques.

CO4:Basics of population genetics to understand evolutionary mechanisms affecting gene frequencies and leading to speciation.

SUGGESTED READING MATERIAL

1. Edwin H. Mcconkey, 1993. Human genetics, The molecular revolution.
2. Brown, T. A. (2006) Gene cloning and DNA analysis and introduction (5th Edition), Oxford, Blackwell Publishers.
3. Gardner, E.J., Simmons, M.J. & Snustad, P. Principles of Genetics, 1991, 1991, John Wiley & Sons Inc. New York.
4. Lodish, H., Berk, A., Matsudaira, P., Kiser, C. A., Kriger, M., Scott, M. P., Zipursky, S.L. and Darnell, J. (2004) Molecular Cell Biology, 5th Edition W.H. Freeman and Company, New York.
5. Seth, P.K. & Seth, S. 1994, Human Genetics, New perspectives, Omega Scientific Publishers.
6. Strachan, Tom and Read, A.W. Human Molecular Genetics 2004, Garland Science London, New York.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Ecology & Limnology

SUBJECT CODE: MZOO-1202

SEMESTER: II

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of interaction of man with their surrounding environments.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia and research.

Contents of the Syllabus:

UNIT-I	1. Population Ecology: 1.1 Population attributes. 1.2 Population interactions. 1.3 Survivorship Curves
UNIT-II	2. Communities: 2.1 Community characteristics. 2.2 Ecological Succession 3 Biological Invasions: 3.1 Ecological impacts of Invasive species 3.2 Ecology of exotic species..
UNIT-III	4. Aquatic Ecosystems 4.1 Standing water – lakes, ponds, wetlands. 4.2 Flowing waters- rivers, streams and riparian habitats. 4.3 Marine water 4.4 Eutrophic ecosystems 5. Pollution of water: 5.1 Types and effects of water pollutants 5.2 Pollution indicators
UNIT-IV	6. Ecology of space travel 6.1 Life support systems (Mechanical, Chemoregeneration). 6.2 Exobiology. Industrialization and ecological consequences

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Biotic and abiotic factors that influence communities and ecosystems.

CO2: Exobiology.

CO3: Types and characteristics of different aquatic ecosystems.

CO4: Pollution indicators and water quality indices.

SUGGESTED READING MATERIAL

1. Findlay SEG and Sinsabaugh R. L. (2003). Aquatic ecosystems, Academic Press, U.S.A.
2. M. Jafferries (1990) Fresh Water Ecology: Principles & Application. Q. D. Mills CBS Publishers, New Delhi.
3. Wetzel, R. G. (2001). Limnology. Elsevier Academic Press . Sandiago.
4. Wetzel R. G. and Likens , G. E. (2004). Limnological analysis . Springer India. Pvt. Ltd.
5. Smith, R and Smith, T. 2005. Elements of Ecology (5th Edition). Pearson Publishers, USA
6. Odum, E and Barrett, Gary W. 2005. Fundamentals of Ecology Thompson Publishers, USA
7. Nentwig, W. 2006. Biological Invasions. Springer Publishers
8. Cockwood, J. Hoopes, Martha and Marchetti, Michael (2006) Invasion Ecology. Blackwell Publishers, UK

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: General Physiology

SUBJECT CODE: MZOO-1203

SEMESTER: II

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of physiology of human body.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching/research.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Digestion 1.1 Types of nutrition. 1.2 Feeding mechanism. 1.3 Digestion of dietary constituents. 1.4 Gut movements. 1.5 Regulation of digestive processes and absorption. 2. Excretion 2.1 Kidney structure. 2.2 Juxtaglomerular apparatus. 2.3 Urine formation. 2.4 Renin angiotensin system.	15
UNIT-II	3. Blood 3.1 Composition and functions of blood 3.2 Haematopoiesis 3.3 Blood groups and Rh system. 4. Heart 4.1 Origin and conduction of heart beat 4.2 Cardiac cycle 4.3 Cardiac output 4.4 Blood pressure	15
UNIT-III	5. Respiration 5.1 Transport of O ₂ and CO ₂ 5.2 Oxygen dissociation curve of haemoglobin 5.3 Bohr effect	7



	5.4 Haldane shift 5.5 Chloride shift. 6. Muscles 6.1 Ultra structure of skeletal muscle. 6.2 Contractile proteins. 6.3 Mechanism of Muscle contraction.	
UNIT-IV	7. Neural integration 7.1 Structure of neuron 7.2 Resting membrane potential 7.3 Action potential. 7.4 Na ⁺ -K ⁺ transport system 7.5 Origin and propagation of nerve impulse 7.6 Structure of chemical synapse	8

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Understand the mechanisms and functioning of the human body.

CO2: Physiology of digestive, circulatory, excretory, neural, endocrine systems.

CO3: Anatomy of various organs.

CO4: Interactions and interdependence of physiological processes.

SUGGESTED READING MATERIAL

1. Ganong, W.F. 2003. Review of Medical Physiology, 21st Edition. Appleton & Lange (A Publishing Division of Prentice Hall).
2. Giese, A.C. (Third Edition), 1979: Cell Physiology W.B. Saunders Company, Toppan Company Ltd., Tokyo.
3. Guyton, A.,G. 1986, Text Book of Medical Physiology 7th edition Sanders Publication.
4. Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusetts, USA.
5. Withers, P.C. (1992), Comparative Animal Physiology Saunder College Publishing, New York.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: BIOCHEMISTRY

SUBJECT CODE: MZOO-1204

SEMESTER: II

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of biochemistry
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Basic concepts of Hydrogen bonding, Vander Waal's, Electrostatic and Hydrophobic interactions. 2. Chemical structures of biomolecules: Starch, Glycogen, Cellulose, Chitin, Hyaluronate, Chondroitin sulphate and Keratin sulphate. 2.1 Basic structure and classification of Amino acids. 2.2 Biologically active peptides- Glutathione, Aspartame, Enkephalins, Oxytocine & Vassopressin	12
UNIT-II	1. Super secondary structures in Proteins 1.1 Protein denaturation and folding 1.2 Abnormal Hemoglobins. 2. Degradation and Biosynthesis: 2.1 Degradation of glucose and Palmitic acid. 2.2 Biosynthesis of urea. 2.3 Gluconeogenesis. 2.4 Glycogen synthesis	12
UNIT-III	1. Bioenergetics: 1.1 Mitochondrial Electron transport chain. 1.2 Mechanism of Mitochondrial oxidative phosphorylation: Chemiosmotic theory. 2. Storage and utilization of Biological Energy. 2.1 ATP- Cycle and energy rich phosphate compounds. 2.2 Role of ATP in various biological functions.	12
UNIT-IV	1. Structure and Functions of Enzymes: 1.1 Mechanism of Enzyme activity: Reactions of enzymes	9



	chymotrypsin and tyrosyl-tRNA synthetase at their active sites. 1.2 Allosteric Enzymes & Isozymes. 1.3 Sigmoidal kinetics of Allosteric enzymes. 2. Immobilized enzymes and their applications.	
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Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Chemical structures of biomolecules.

CO2:Degradation and Biosynthetic reactions

CO3:Bioenergetics

CO4:Immobilised enzymes, mechanism of their action and applications.

SUGGESTED READING MATERIAL

1. Biochemistry by Mary K. Campbell Saunders and Harcourt Brace company. Florida (1999)
2. Principles of Biochemistry by Albert Lehninger, David L. Nelson and Michael M.Cox. CBS Publishers. Delhi. (2000)
3. Harper's Biochemistry, International 1 25thed. Robert K. Murray, peter A. Mayes, Daryl K. Granner. Victor W. Rodwell. McGraw Hill. Lange Medical books (1999)
4. Outline of Biochemistry, Eric. C. Conn, Paul K. Stump. George Bruening, Roy, H. Ooi, John wiley and sons, New York.
5. A Text-book of Biochemistry by Edward Staunton, Wilbert, K. Todd, Howard S. Mason, John T. Van Bruggen. Macmillon Publishing Co. (1974).

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: RESEARCH METHODOLOGY & INSTRUMENTATION

SUBJECT CODE: MZOO-1205

SEMESTER: II

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of use of information technology in the field of biosciences, biotechnology and nanotechnology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

UNIT-I Microscopy : Principle, structural parts and applications of compound microscope, phase – contrast microscope, fluorescence microscope, transmission electron microscope and scanning electron microscope.

UNIT-II Cell fractionation & Electrophoresis: Principle of centrifugation and ultracentrifugation, structural parts of an analytical ultracentrifuge, Principle of electrophoresis, Brief introduction to paper electrophoresis, agarose gel electrophoresis, polyacrylamide gel electrophoresis, SDS-PAGE.

UNIT-III PCR & Spectrophotometry: Polymerase chain reaction (PCR) and its application. Principle and structural parts of spectrophotometer and their applications.

Section-B

Unit -IV Foundations of Research: Meaning, Objectives, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied, Research Methods vs Methodology Research Design 8 Important concepts related to good design

Unit V: Data Collection: Methods of data collection- Sampling Methods, Data Processing and Analysis, Research paper and Thesis writing.

Unit VI: Ethical Issues: Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Identify ethical issues in research.

CO2: Know the importance of research designs, parametric and non – parametric tests

CO3: Skills in basic and advanced instrumentations used in the laboratories



RIMT
UNIVERSITY

Program name: Master of Zoology
Program Code: ZOO 401

CO4: Conventions for scholarly writing.

SUGGESTED READINGS

- Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
- Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.
- Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
- C.R.Kothari: Research Methodology, New Age International, 2009
- Coley, S.M. and Scheinberg, C.A. 1990, "Proposal writing". Stage Publications.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: General Immunology

SUBJECT CODE: MZOO-1206

SEMESTER: II

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of immune system of our body
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experimental research.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Introduction: Innate immunity, Adaptive (specific) immunity, comparative immunity, Immune dysfunction and its consequences. 2. Cells and organs of the Immune system: Hematopoiesis, cells of the immune system, organs of immune system.	11
UNIT-II	1. Antigens : Factors responsible for the generation of Antigenicity, Epitopes and Haptens. 2. Immunoglobulin: Basic structure sequencing studies, Fine structure, classes and Biological activities, Antigenic determinants, B. cell receptors.	11
UNIT-III	1. Antigen-Anti body interactions: Strength, cross reactivity, precipitation, agglutination, Radio-immunoassay, enzyme linked immune sorbent Assay, Westerns blotting immune precipitation, immune fluorescence, Flow cytometry and fluorescence, immunoelectron microscopy. 2. Antigen Processing and Presentation: Role of Antigenic Presenting cells, Evidence of Two Processing and Presentations pathways, Endogenous Antigens Presentation of Nonpeptide Bacterial Agents.	11
UNIT-IV	1. T-cell: Structure of T-cell receptors, T-cell receptor complex: TCR-CD3, T-cell Accessory Membrane molecules. Ternary TCR-Peptide-MHC complex, T-cell maturation and Thymus, Thymic selection of the T-cell Repertoire, T-H cell Activation T-cell Differentiation.	12



	2. B-cell Generation, Activation and differentiation.	
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Course Outcomes (CO)/Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:In depth knowledge of tissues, cells and molecules involved in host defense mechanisms.

CO2:Interactions of antigens, antibodies, complements and other immune components.

CO3:Principle and applications of techniques used in Immunology.

CO4:B cells and T cells activation and differentiation.

SUGGESTED READING MATERIAL

1. Cooper, E.L., 1976: Comparative Immunology, Prentice Hall.
2. Robert M. Coleman, Mary F. Lanbard and Raymond E.S. Card, 1992: Fundamental Immunology Wm. C. Brown Publishers.
3. Roitt, I.M., Brostoff. J. and Male, D.K., 1985: Immunology Churchil Livingstone.
4. Tragger, W., 1986: Living Together- The Biology of Animal Parasitism, Plenum Press.
5. Ruben, L.N. and Gershwin, M.E., 1982: Immune Regulation.
6. Kuby (2012) Immunology. W.H. Freeman & Company, NewYork.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Practical Paper-I (Cytogenetics and population genetics, ecology and limnology and general physiology)

SUBJECT CODE: MZOO-1201

SEMESTER: II

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

- To study the Mandelian monohybrid and dihybrid crosses.
- To study the Barr body formation in mucus cell.
- To make Karyotype arrangement of chromosomes (Normal/mutated).
- To visit and make a project report on any wetland.
- To study Benthic organisms.
- Study the permanent section of Stomach, Esophagus, Intestine, Spleen, Liver, Pancreas.
- To measure the Blood pressure of human subject.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Chromosome slide preparations.

CO2: Perform monohybrid and dihybrid crosses.

CO3: Interactions of Biota and abiota.

CO4: Physiological tests to check functioning of body.



SUBJECT TITLE: Practical Paper-II (Biochemistry, Research Methodology and General Immunology)

SUBJECT CODE: MZOO-1208

SEMESTER: II

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

- To detect the presence of carbohydrates in the given samples.
- To detect the presence of Proteins in given sample.
- To detect the presence of Lipids in given sample.
- To study the morphology of various WBCs in human blood.
- To make a temporary thin and thick blood films of human sample.
- Isolation of WBCs and counting by hemocytometer.
- Demonstration of compound microscope, phase – contrast microscope.
- Demonstration of centrifugation, agarose gel electrophoresis, polyacrylamide gel electrophoresis.
- Demonstration of Polymerase chain reaction (PCR), Principle and structural parts of spectrophotometer.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Perform Biochemical tests on human samples.

CO2: Isolation of WBCs and Morphology of WBCs.

CO3: Counting of blood cells.

CO4: Equipments like different microscopes, haemocytometer, thermocycler, electrophoretic units.



Third Semester:

SUBJECT TITLE: Animal Behavior

SUBJECT CODE: MZOO-2301

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of animal behavior.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Animal Psychology- Classification of behavioural patterns Analysis of Behaviour (ethogram) Innate Behaviour 2. Perception of environment: Chemical Olfactory Auditory Visual Acoustic behavior	15 hours
UNIT-II	3. Control of behaviour : Neural Hormonal 4. Communication : Chemical Visual Audio Evolution of language (primates)	10 hours
UNIT-III	5. Social Behaviour: Aggregation Schooling in fishes Flocking in birds Group selection, kin selection, altruism Social organization in insects and primates. 6. Reproductive Behaviour: Mating systems	10 hours



	Courtship Sperm competition Parental Care	
UNIT-IV	7.Biological Rhythms: Circadian and Circannual rhythms Orientation and navigation.. Migration of fishes & birds 8.Learning and memory Insight learning Association learning Reasoning Cognitive skills	10 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Innate and Learning behaviour and its correlation to human behaviour under given situation.

CO2:Perception of environment.

CO3:Biological rhythms, social organization, migration and navigation.

CO4:Neural & Hormonal Control of Behavior.

Recommended Books:

- 1.Alcock, J. (2005) Animal behaviour : An evolutionary approach, Sinauer Assoc., Sunderland, Mass. USA.
- 2.Goodenough, J., McGurie and Wallace, R. A. (2001) Perspective on animal behaviour. John Wiley & Sons, Inc. New York.
- 3.Bradbury, J.W., and S.L. Verhrencamp. (1998) Principles of Animal Communication, Sinauer Assoc., Sunderland, Mass. USA.
- 4.Clutton-Brock, T.H. (1991) The evolution of Parental care, Princeton Univ. Press, Princeton, NJ, USA.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: General Endocrinology

SUBJECT CODE: MZOO-2302

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of general endocrinology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1.Hormones and Hormone Action: Classification of Hormones Storage and secretions of Hormones Mechanism of Hormone action: Membrane bound receptors Intracellular receptors Second messengers in hormone action : cAMP, cGMP, calcium ions, phosphoinositides and protein kinase cascade Control of Hormone Secretion Measurement of Hormones in blood Autacoids	15 hours
UNIT-II	2.Hypothalamus and pituitary gland: The pituitary gland and its relation to the hypothalamus Control of pituitary secretion by hypothalamus Physiological functions and regulation of growth hormone Abnormalities of growth hormone secretion Neurohypophyseal Hormones: Chemical nature and physiological functions of Antidiuretic hormone (Vassopressin) and oxytocin.	10 hours
UNIT-III	3. Thyroid Hormones : Biosynthesis and Secretion of Thyroid hormones. Physiological functions of thyroid hormones	10 hours



	Regulation of thyroid hormones Antithyroid substances Abnormalities of thyroid hormones 4. Parathyroid hormones: Physiological anatomy of Parathyroid glands Effect of parathyroid hormone on calcium and phosphate Metabolism Regulation of parathyroid secretions 5. Calcitonin and its control on calcium ion concentration	
UNIT-IV	6. Adrenocortical Hormones : Functions of the Glucocorticoids on metabolism Regulation of cortisol secretion 7. Catecholamines : Biosynthesis and Metabolism of Epinephrine and norepinephrine. Physiological effects of catecholamines 8. Pancreas and its Hormones : Insulin and its Metabolic effects Glucagon and its effect on glucose Metabolism.	10 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

- CO1:** Thorough knowledge of structure and function of different glands.
- CO2:** Mode and mechanism of hormone action.
- CO3:** Hormones mediated metabolism and regulation.
- CO4:** Abnormalities associated with hyper and hypo secretion of hormones.

Recommended Books:

- 1.E.J.W. Barrington (1975) General and comparative Endocrinology, oxford, clarendon press.
- 2.Guyton, AG and Hall J.E (2006) Text book of Medical Physiology 11th Ed, saunders publications.
- 3.William F. Ganong (2003) Review of medical physiology, international 21st edition M C Graw Hill companies .
- 4.P.J. Bentley, Comparative vertebrate Endocrinology, Cambridge University Press, 1976.
- 5.R.H. Williams: Text Book of Endocrinology, W,B. Saunders.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Bioanalytical & Statistical Techniques

SUBJECT CODE: MZOO-2303

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of bioanalytical and statistical techniques.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus

Sr. No	Contents	Contact Hours
UNIT-I	1.Principles and applications of Phase contrast microscope Fluorescence microscope Scanning electron microscopy (SEM) and Transmission electron microscopy (TEM) 2.Principles and applications of Thin layer chromatography (TLC) Gas liquid chromatography (GLC) High pressure liquid chromatography (HPLC) Ion exchange and affinity chromatography	15 hours
UNIT-II	3.Basic statistics Measures of central tendency- Arithmetic mean, geometric mean, harmonic mean, median, mode, z-score, quartiles, deciles, percentiles Measures of dispersion- Range, quartile deviation, mean deviation, variance, standard deviation, standard error, coefficient of variation 4.Probability- Basic concept of probability, probability distributions (Normal, Binomial and Poisson)	15 hours
UNIT-III	5.Correlation and regression- Linear and non-linear correlation, measures of correlation, regression coefficient, types of correlation 6.Analysis of variance- Types of ANOVA, F-test, computation of	7 hours



	analysis of variance	
UNIT-IV	7.Student's t-test- Degree of freedom, t-test for single mean and grouped data, types of t-tests 8.Chi-square test- Determination of chi-square, chi-square distribution, 2×2 contingency table	8 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Different instruments, their principles and applications.

CO2: Statistical methods.

CO3: Application of learnt techniques to biological sciences.

CO4: Analysis of real world data.

Recommended readings

- 1.Lehninger, A. Nelson, Dand Cox 2003. Principles of Biochemistry. CBS Publishers, New Delhi.
- 2.Wilson, K and walker John 2005. Principles and Techniques of Biochemistry. Cambridge University Press.
- 3.Stefen 2005. Basic Techniques in Molecular Biology. Springer Publishers.
- 4.Ranjit Kumar 2002. Research Methodology;A step by step Guide for beginners sage publishers.
- 5.Bailey, N.T.J. (1995). Statistical Methods in Biology. Cambridge University Press, Cambridge.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: SPCL-I : Insect Morphology & Applied Entomology

SUBJECT CODE: MZOO-2304

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of insect morphology and applied entomology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1.Morphology of facial sutures 2.The types of antennae in Insects 3.Morphology of generalized & specialized mouth parts.	15 hours
UNIT-II	4.The neck region in Insects 5.Topography of typical tergum, sternum and pleuron 6.Generalized structure of wing and wing modifications	7 hours
UNIT-III	7.Generalized structure of Insect leg and leg modifications. 8. Pregenital , genital and post genital appendages	8 hours
UNIT-IV	9.Insect pests : emergence of pests and pest resurgence 10. Arthropods as vectors of human diseases. 11.Life history, mode of damage and control of insect pests of cotton, wheat, sugarcane, rice, pulses, oil seeds, vegetables and house hold pests.	15 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Morphology of generalized & specialized insect mouth parts.

CO2: Generalized structure of insect wing, legs and their modifications.

CO3: Life History of insects.

CO4: Insect pests and Vectors of diseases.



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Recommended Books:

1. Snodgrass, R.E. Principles of Insect Morphology, A.D. Imm's General Text-Book of Entomology.
2. Richard & Davis Entomology, 1st and 2nd Vols.
3. Mayr, E. Principles of Systematic Zoology.
4. Kapoor V.C. theory and Practices of Animal Taxonomy.
5. Henning, W. Insect Phylogeny.
6. Bland & Jaques. How to know the Insects (Practical Book)
7. Matsuda, R. Morphology and Evolution of Insect Head.
8. Du Porte E.M., Manual of Insect Morphology.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists of three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: SPCL-II: Insect Anatomy & Toxicology

SUBJECT CODE: MZOO-2305

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of insect anatomy and toxicology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Metamorphosis: Types Hormonal control. 2. Digestive system: Anatomy of digestive system in various insects	11 hours
UNIT-II	3. Excretory system: Structure of excretory organs Physiology of excretion 4. Respiratory system: Structure	11 hours
UNIT-III	5. Scope of toxicology Mode of action of various insecticides Routes and site of toxicity 6. Biological control Procedures Parasites Predators	11 hours
UNIT-IV	7. Resistance to insecticides Basic principles of insect pest control Quarantine Mechanical control Physical methods of control	12 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Different types of metamorphosis.

CO2: Physiology of digestion, excretion and respiration.

CO3: Different types of insecticides and their mode of actions.

CO4: Biological control agents.

Recommended Books:

1. Ross, Herbert H. Ross, Charles A. & Ross, June R.P. 1982: Text Book of Entomology, edn.4, John Wiley & Sons, New York.
2. Mani, M.S. 1982: General Entomology, Edn.3 Oxford & IBH Publishing Co., New Delhi.
3. Wigglesworth, V.B. 1965: The Principles of insect physiology, English Language Book Society & Methune & Co. Ltd.
4. Chapman, R.F. 1984: The Insect Structure and Function, English University Press.
5. Beament: J.W.L. Treherne, J.E. & Wigglesworth, V.B. (Eds.) 1963: Advances in Insect physiology, Academic Press, New York.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Fish & Fisheries

SUBJECT CODE: MZOO-2306

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of fisheries.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1.Outline classification of fish 2.Teleostei with special reference to following orders: Ceratodontiformes Lepidosueniformes Acipensiformes Amiiformes Semionotiformes Clupeiformes Cyprinodontiformes Perciformes Anguilliformes Beloniformes Gasterosteiformes Gadiformes Pleuronectiformes Tetradontiformes Echeiniformes Ophiocephaliformes	15 hours
UNIT-II	3.Scales : Types, structure and functions 4.Coloration : Chromatophores, pigments and biological significance of coloration in fish 5.Bioluminescence in fish and its significance 6.Electric organs, their structure and use in fish	15 hours
UNIT-III	7.Respiratory organs 8.Structure, modification and function of gills	10 hours



	9. Air breathing accessory organs 10. Swim bladder	
UNIT-IV	11. Lateral line organs 12. Ultimobranchial glands 13. Corpuscles of Stannius 14. Biochemical composition and preservation of fish Biochemical composition of fish Nutritional value of fish Poisoning toxicity and allergies from fish as food Fish preservation	10 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Detailed classification and general characteristics of fishes belonging to some important orders.

CO2: Fish scales, coloration, bioluminescence and electric organs.

CO3: Respiratory and lateral line organs.

CO4: Knowledge of biochemical composition, preservation and nutritional value of fish.

Recommended Books:

1. Jhingran, V.G. 1991, Fish and Fisheries of India, Hindustan Publishing House (India), New Delhi, India.
2. Talwar, P.K., Jhingran, A.G. 1991, Inland Fishes of India, Vols I & II, Oxford & IBH, New Delhi, India.
3. Toor, H. S. and Kaur, K. (1996), Fish Culture manual. PAU, Ludhiana.
4. Shami, Q. J. and Bhatnagar, S. (2002) Applied Fisheries . Agrobios India.
5. Pandey, K. and Shukla, J.P. (2010) Fish & Fisheries. Rastogi Publications.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: SPCL: II Fish Production Technology

SUBJECT CODE: MZOO-2307

SEMESTER: III

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of fish production technology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1.Principle of aquaculture: Different systems of Aquaculture. Extensive System Intensive System Semi-Intensive System Flow-through & Recirculatory System 2.Farming Methods: Ponds Pens Cages Raceway Monoculture Polyculture Mixed/Composite Culture	12 hours
UNIT-II	3.Sewage fed fisheries Introduction Treatment Methods Species cultured under SWF 4.Integrated fish farming & recycling of wastes Fish-cum-Poultry Farming Fish-cum-Pig Farming Fish-cum-Paddy Farming Fish-cum-Duck Farming Fish-cum-Dairy Farming Fish-cum-Horticulture Farming	13 hours
UNIT-III	5.Pond Productivity	13 hours



	Primary Productivity Secondary Productivity Physical, chemical & biological factors affecting productivity of ponds 6. Fish pond design, construction & operational management Site selection, nutrient & soil quality Water supply & water circulation Soil & water quality management & fertilization	
UNIT-IV	7. Fish Nutrition: Natural & formulated feeds Nutrient requirement of fish Fish feed formulation Feeding strategies	7 hours

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Basic concept of aquaculture and farming methods.

CO2: Integrated fish farming & recycling of wastes.

CO3: Knowledge of pond productivity, pond design and water supply.

CO4: Comprehensive knowledge of fish nutrition, feed formulations and feeding strategies.

Recommended Books:

1. Toor, H. S. and Kaur, K. (1996), Fish Culture manual. PAU, Ludhiana.

2. Findlay SEG and Sinsabaugh R. L. (2003). Aquatic ecosystems, Academic Press, U.S.A.

3. Yadav, B.N. (1993) Fish & Fisheries. Daya Publishing House

4. Rathy, R.K. (2011) Freshwater Aquaculture, Scientific Publication.

INSTRUCTIONS FOR THE PAPER-SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Practical Paper-I

SUBJECT CODE: MZOO-2308

SEMESTER: III

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Duration of Exam; 3 Hrs

PRACTICAL PAPER-I (MZOO-2308)

(Pertaining to papers MZOO-2301, MZOO-2302 & MZOO-2303)

1. To study the behavior of rat by using the "Skinner's Boxes"
2. Habituation/Sensitization in mosquito larvae.
3. To study the Grooming behavior of Cockroach.
4. To study the predation behavior of Rats.
5. Simulating the dilution, confusion and odd prey effects.
6. To study the rolling behavior of pill bugs.
7. To assess the importance of a visual stimulus (background colour/brightness) on an individual's decision to position itself relative to it.
8. To assess the importance of an olfactory stimulus (background food/odorant) on an individual's decision to position itself relative to it.
9. To study the Process of spermatogenesis, process of oogenesis, Corpus luteum, Structure of sperm, Parathyroid gland, Sickle cell anemia, Mammary gland & Calcified and decalcified bone.
10. To demonstrate the abnormalities of growth hormone: Dwarfism, Gigantism and Acromegaly etc.
11. To demonstrate the abnormalities related to Thyroid Gland: Hyperthyroidism Exophthalmos, Goiter and Grave's disease; Hypothyroidism Myxedema, Cretinism.
12. To demonstrate the abnormalities of Adrenal Gland: Cushing Syndrome.
13. To study the principle, working and applications of Compound microscope.
14. To study the principle, working and applications of Stereo zoom microscope.
15. To study the principle, working and applications of Phase contrast microscope.
16. To study the principle, working and applications of Fluorescent microscope.
17. To study the principle, working and applications of Spectrophotometer.
18. To prepare the chromatograph for different inks/oils by paper chromatography.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Simulation of behavior experiments.

CO2:Spermatogenesis and oogenesis process.

CO3:Abnormalities of various glands.

CO4:Different kinds of laboratory instruments.



SUBJECT TITLE: Practical Paper-II

SUBJECT CODE: MZOO--2309

SEMESTER: III

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Duration of Exam; 3 Hrs

Specialization: ENTOMOLOGY

SPCL-1 (MZOO-2304)

1. Morphology of head region (Sutures, Structure, Tentorium etc.)
2. Morphology of thorax
3. Wing and its modifications
4. Morphology of abdomen & genitalic structures
5. To study digestive system of Ak grasshopper.

SPCL-2 (MZOO-2305)

1. To study Nervous system of Ak grass hopper.
2. To study internal reproductive system of an insect.
3. To study excretory system of different insects.
4. To study respiratory system of different insects.
5. To study circulatory system of different insects.
6. To prepare assignment s on
 - a. Nerve conduction in insects.
 - b. Muscle contraction

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Different organs and organ systems of insects.

CO2: Morphology of head.

CO3: Morphology of thorax and wings.

CO4: Morphology of abdomen and genitalia.

Specialization: FISHERIES

SPCL-1 (MZOO-2306)

1. To identify, classify and study morphological characteristics of Chondrichthyes fishes.
2. To identify, classify and study morphological characteristics of Osteichthyes fishes
3. To prepare permanent slides of Placoid scales.
4. To prepare permanent slides of Ctenoid scales.
5. To prepare permanent slides of Cycloid scales.
6. To prepare permanent slides of Ganoid scales.
7. To prepare permanent slides of ampulla of lorenzini.

SPCL-II (MZOO-2307)

1. Identification of important cultivable freshwater fish and prawn species.
2. Water and soil quality analysis.
3. Impact of manuring on water quality, plankton production and fish growth.
4. Estimation of pond productivity.
5. Formulation and preparation of balanced fish feed.



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6. Proximate analysis of fish feed.

CO1: Characters and Classification of Chondrichthyes and Osteichthyes.

CO2: Different types of Fish Scales and their slide preparation..

CO3: Preparation of Fish feed.

CO4: Estimation of pond productivity.



FOURTH SEMESTER

SUBJECT TITLE: INDUSTRIAL ZOOLOGY

SUBJECT CODE: MZOO-2401

SEMESTER: IV

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Industrial Zoology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Aquaculture : definition and impending food crisis 2. Prawn culture 3. Pearl culture	15
UNIT-II	4. Poultry farming 5. Breeds of chicken birds and scientific methods of breeding 6. Common diseases such as: b) Ranikhet disease c) Fowl pox d) Coccidiosis e) Salmonella	15
UNIT-III	7. Development and maintenance of meat animals and meat industry 8. Exotic and indigenous breeds of sheep, goat, pig	7
UNIT-IV	9. Status of dairy industry in India, development and maintenance of dairy animals 10. Dairy products (milk, cream, cheese, butter)	8



COURSE OUTCOMES (CO)/ LEARNING OUTCOMES.

ON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL GET/LEARN:

CO1: Prawn culture and pearl culture.

CO2: Poultry farming.

CO3: Meat and dairy industry.

CO4: Common diseases of poultry.

SUGGESTED READINGS.

1. Pillay, T.V.R. and Kutty, M.N. 2005. Aquaculture: Principles and Practices (2nd Edition) . Blackwell Publishing Ltd. Oxford U.K
2. Bhamrah, H. S. & Juneja, K. (2001), An introduction to Mollusca. Anmol publications Pvt., Ltd. New Delhi.
3. Bhatnagar, R. K. and Palta, R. K. (2003), Earthworm; Vermiculture and Vermicomposting , Kalyani Publishers India.
4. Carter, G. A. (2004) Beekeeping , Biotech Books, New Delhi.
5. Fenemore, P. G. and Prakash, A. (1992), Applied Entomology, Wiley Eastern Ltd. New Delhi.
6. Ghorai, N. (1995), Lac Culture in India. International Books and Periodicals, New Delhi.
7. Jhingran , V. G. (1991) Fish and Fisheries of India, Hindustan Publishing Company
8. Sobti, R. C. (1992), Medical Zoology, Nagin Chand & Co. Jalandhar.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: WILD LIFE & ITS MANAGEMENT

SUBJECT CODE: MZOO-2402

SEMESTER: IV

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Wild life and its management strategies
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Introduction to wild life. 2. Wild life management Principles: Food Cover Predators Diseases.	20
UNIT-II	1. Important wild animals of India (mammals and birds) 2. Factors important in wild life management: Water Soil Exotic animals	10
UNIT-III	1. Wild life protection Act: Hunting of wild animals. Sanctuaries and National parks Central Zoo Authority Trade in wild animals	10
UNIT-IV	1. Conservation biology Conflict between man and wild life. Wild life conservation projects of India Modern practices in wild life conservation.	20

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: General principles of ecology and its relationship with wildlife conservation.

CO2: Important wild animals of India.

CO3: Acquaintance with Wildlife Protection Act.

CO4: Modern practices of Wildlife Conservation in India.

SUGGESTED READINGS

1. Aggarwal, (2000), Wildlife of India.
2. Ali, S. (1971), The Books of Indian Birds, Bombay Natural History Society, Bombay.
3. Burton, L. D. (2003), Fish and Wildlife: Principles of Zoology and Ecology. Delmar Thompson Learning Pb.
4. Dasmann, R. F., (1982), Wildlife Biology, Wiley Eastern, New Delhi.
5. Fulbright, Timothy, E. and Hewitt, D. G. (2008). Wildlife Science: Linking Ecological Theory and Management Applications. CRC Press, Taylor and Francis: BocaRaton, F L.
6. Giles, R. H. (1984), Wildlife Management Techniques, Natraj Publishers, Dehradun.
7. Gopal, R. (1992), Fundamental of Wildlife management Justice Home Allahabad.
8. Hosetti, B. B. (1997), Concepts in Wildlife Management, Chawla Press, Delhi.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Zoogeography & Evolution

SUBJECT CODE: MZOO-2403

SEMESTER: IV

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Zoogeographic realms, their flora, fauna and evolution.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1 Zoogeography: 1.1 Zoogeographical realms 1.2 Origin of major group of animals 1.3 Patterns of extinction and diversification.	20
UNIT-II	2 Island theory and conservation: 2.1 Habitats as Islands 2.2 Island biogeography theory 2.3 Speciation and Island conditions	10
UNIT-III	3 Nature of Evolution: 3.1 Complexity of interactions between population and environment 3.2 Reaction of organism to environmental complexity 3.3 Sub-specific and trans-specific aspects of evolution	10
UNIT-IV	4 Origin of variation: 4.1 Rates of mutations and rates of evolution 4.2 Evolution of genome 4.3 Diversification of natural selection	20



RIMT
UNIVERSITY

Program name: Master of Zoology
Program Code: ZOO 401

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1:Zoogeographical regions.

CO2:Island biogeography theory and conservation strategies.

CO3:Nature of evolution, sub-specific and trans-specific aspects of evolution.

CO4: Rates of mutations and rates of evolution.

SUGGESTED READINGS

2. Whittaker, R.J.1998. Island Biogeography: Ecology, Evolution and conservation Oxford University Press, New York.
3. Freeman, S. and Herron, Jon C. (2007). Evolutionary Analysis Pearson Prentice Hall, New Jersey.
4. Wen-Hsiung Li (1997), Molecular Evolution, Sinauer Associates Inc.Pub. USA.
5. Futuyma, D.J. 2005. Evolution. Sinauer Associates Inc., USA .

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: PARASITOLOGY

SUBJECT CODE: MZOO-2404

SEMESTER: IV

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of aquatic ecosystems.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

SECTION-A

Protozoa: General organization and outline classification of parasitic protozoa Epidemiology, morphology, life cycle, pathogenicity, and control of *Entamoeba histolytica*, *Balantidium coli*, *Giardia lamblia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma* and *Cryptosporidium*.

SECTION –B

Trematoda: General organization and outline classification of digenetic trematodes, variation in Life cycle in *Digenea*, Ultrastructure of body wall of digenetic trematodes Epidemiology, morphology, life cycle, pathogenicity, and control of *Fasciola hepatica*, *Fasciola buski* and *Paragonimus westermani* and Schistosomes.

SECTION –C

Cestoda: General Organisation and outline classification of cestoda, various larval forms and ultrastructure of the body wall of cestodes Epidemiology, morphology, Life cycle, pathogenicity and control of *Diphyllobothrium latum*, *Taenia solium*, *T. saginata*, *Echinococcus granulosus*, *Hymenolepis diminuta*, *H.nana*, *Dipylidium caninum* including sparganosis, cysticercosis and hydatid disease.

SECTION –D

Nematoda: General organization, classification and life cycle patterns Epidemiology, morphology, life cycle, pathogenicity and control of *Trichuris trichiura*, *Trichinella spiralis*, *Ascaris lumbricoides*, *Enterobius vermicularis* *Ancylostoma duodenale*, *Necator americanus*, *Sptrongyloides stercoralis* *Wuchereria bancrofti*, *Onchocerca volvulus* and *Dracunculus medinensis*.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Classification, morphology and life cycle of different parasites.

CO2: Human and non-human parasitic diseases.

CO3: Impacts of parasitic diseases on human societies.

CO4: Parasite/host relationship.

Suggested readings:

- Parasitology protozoology and helminthology by K.D. Chatterjee 13th Edition
- Paniker's Textbook of Medical Parasitology by Sougata Ghosh.
- Human Parasitology by Burton J. Bogitsh, Clint E. Carter, et al.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one mark each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Recent Advances in Entomology

SUBJECT CODE: MZOO-2407

SEMESTER: IV

CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of advancements in entomology.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of the Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1. Mantophasmatodea: A New Insect Taxon 1.1 Characters 1.2 Classification 2. Learning and Behaviour 2.1 Neural Basis of Learning 2.2 Bee Language 2.3 Colour Change Mechanism and Adaptive Behaviour	20
UNIT-II	3. Immunity in insects 3.1 Antibacterial Immunity 3.2 Bacterial Resistance to Insect Immunity	10
UNIT-III	4. Insect viruses and Pest Control 4.1 Insect Viruses 4.2 Viruses as Biological Control Agents of Insect Pests	10
UNIT-IV	5. Forensic Entomology	20



	5.1 Principle and Scope	
	5.2 Forensic Insects & Factors	

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Comprehensive idea of Mantaphasmotodea.

CO2: Learning and language in insects.

CO3: Different Insect viruses and immunity in insects.

CO4: Acquaintance with Forensic Entomology.

SUGGESTED READINGS:

1. Srivastava, K.P, Text Book of Applied Entomology Volume-II (2005).
2. Gullan, P.J. and Cranston, P. The Insects, an outline of Entomology, 3rd Edition (2005). Blackwell Publishing Ltd., USA.
3. Amrose , D.T. The Insects-structure, function and biodiversity (2015)

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT NAME: FISH AND FISHERIES-II

SUBJECT CODE: MZOO-2407

SEMESTER: IV

CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of fish and their internal systems and classification.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career, for example, in research - whether industry or academia - as well as teaching, media, law, commerce, government or management.

Contents of Syllabus:

Sr. No	Contents	Contact Hours
UNIT-I	1.Elasmobranchs Classification Salient features of Elasmobranchs 2.Fins Median and Caudal fins Dorsal and Ventral fins	11 hours
UNIT-II	3. Digestive System Developmental Events in digestive system of Fishes Food and Feeding Food quality Alimentary Canal Digestive Glands	11hours
UNIT-III	4.Accessory Respiratory organs Definition of Accessory Respiratory organs, occurrence, origin Accessory organs of Respiration in fishes	11 hours
UNIT-IV	5.Poison Glands in Fishes Difference between poisonous and venomous fishes Divisions of Poisonous fishes. Chemical and zootoxicological properties of Fish toxins. Nature of Poisonous Fishes	12 hours



Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Acquaintance with Elasmobranch fishes and their classification.

CO2: Digestive system in fishes.

CO3: Accessory respiratory organs.

CO4: Poison Glands in Fishes and Chemical and zootoxicological properties of Fish toxins.

SUGGESTED READINGS

1. Jhingran, V.G. 1991, Fish and Fisheries of India, Hindustan Publishing House (India), New Delhi, India.
2. Talwar, P.K., Jhingran, A.G. 1991, Inland Fishes of India, Vols I & II., Oxford & IBH, New Delhi, India.
3. Toor, H. S. and Kaur, K. (1996), Fish Culture manual. PAU, Ludhiana.
4. Shami, Q. J. and Bhatnagar, S. (2002) Applied Fisheries . Agrobios India.
5. Pandey, K. and Shukla, J.P. (2010) Fish & Fisheries. Rastogi Publications.

INSTRUCTION OF QUESTION PAPER SETTER:

The question paper will consist of three sections: A, B & C. Sections A will consist of twelve multiple choice questions carrying one marks each from all over the syllabus of concerned paper. Section B will have six questions of four marks each and section C consists three questions of eight marks each from the respective sections of the syllabus.



SUBJECT TITLE: Practical Paper-I

SUBJECT CODE: MZOO-2405

SEMESTER: IV

CONTACT HOURS/WEEK: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Duration of Exam; 3 Hrs

MZOO-2401

1. Test for detection of formalin in given milk samples.
2. Test for detection of water in given milk samples.
3. Test for detection of pulverized soap in given milk samples.
4. Test for detection of urea in given milk samples.
5. Test for detection of starch in given milk samples.
6. Test for detection of cane suger in given milk samples.
7. Test for detection of salt in given milk samples.
8. Test for detection of ammonium sulphate in given milk samples.
9. Test for detection of benzoic acid & salicylic acid in given milk samples.
10. Egg structure and evaluation of egg quality.

MZOO-2402

1. To deliver a seminar on a topic related to wild life conservation.
2. To submit an assignment on a topic concerning wild life in India.
3. To prepare a report on the latest events concerning wild animals at the national and international level.
4. To observe the behavior of one wild animal and to write a report on it.
5. To visit a wild life National Park and to submit a report on it.

MZOO-2403

1. To study the habitat, distribution, habits and important characters of various animals: *Naja naja*, Pigeon, *Hystrix* (Porcupine), *Hyla*, *Salamander*, *Apteryx* (kiwi), Flying Squirrel, *Ornithorhynchus*, *Protopterus*, *Peripatus*, *Balanoglossus*, *Archaeopteryx*.
2. To study the vestigial organs in animals.
3. To study the zoogeographic realms of the world.
- . Map studies:
 - a. India – Climatic Regions
 - b. India Rainfall and wind
 - c. India – Distributions of Animals
 - d. Distribution of endangered animal species in Himalayan region
5. Map studies: Biodiversity Hotspots location in (a) World (b) India
6. Map Studies: Protected Areas of India such as National parks, Wildlife Sanctuaries, Biosphere Reserves.
7. To study the Leg modifications in case of insects.

MZOO-2404

1. To study the whole mounts of *Fasciola hepatica*, Tapeworm, *Ascaris*.
2. To make the temporary mount of *Fasciola hepatica*, Tapeworm, *Ascaris*.
3. To study the proglottids of *Fasciola hepatica*.
4. To study the whole mounts of nematodes.
5. To learn the formation of thick and thin blood flim of human blood for identification of various protozoans.
6. To study the life cycle of various human parasites.



Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Detection of adulterants in milk sample.

CO2: Important wild animals at the national and international level.

CO3: Zoogeographical distribution, habits and important characters of various animals.

CO4: Identify and describe different parasites and their life cycles.

MZOO-2406

1. To study the antennal grooming of cockroach.
2. To demonstrate the wing cleaning in *Musca*.
3. Study the response of light in houseflies .
4. To study the life cycle of blowfly and its role in forensic entomology.
5. Enlist the insect fauna of forensic importance from India.
6. To study the elapsed time since death by using insect.
7. Identification of new insect taxon Mantophasmatodea on the basis of characteristics.

Course Outcomes (CO)/ Learning Outcomes.

On successful completion of this course, the student will get/learn:

CO1: Grooming behavior of insects like cockroach and *Musca*.

CO2: Insect Fauna of Forensic importance.

CO3: Life cycle of blowfly and its role in forensic entomology.

CO4:Identifying features of insect order Mantophasmatodea.