DEPARTMENT OF ZOOLOGY

COURSE CURRICULUM & MARKING SCHEME

M.Sc. ZOOLOGY

Semester - II

SESSION : 2023-24

ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

Department of Zoology

Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

Session 2022-24

Learning Outcome Based curriculum for M. Sc. Zoology

Program Specific Outcome (PSO): M. Sc. Zoology

The programme enables the students:

- To comprehend knowledge of biology in a diversity of organisms encompassing differentecosystem levels
- To develop practical skills and ability to perform experiments and analysis through appropriate application of statistical tools and technologies to obtain accurate results and thus gain the ability to solve problems.
- To develop cognitive and hands-on skills in advanced scientific methods and their uses inapplied and advanced zoological sciences
- To connect, comprehend and apply the value of the diversity and complexity of animal life as revealed through studies on morphology, physiology, cellular and molecular biology and biochemistry.
- Acquire knowledge and critical analytical skills on different scientific arenas such as immunology, endocrinology, microbiology and genetics
- Be proficient at critical thinking, annotation and communication of scientific information and able to succeed in competitive examinations and interviews.

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....

Syllabus for M. Sc. Zoology by the Members of Board of Studies for session 2022 -23 and 2023-24

Semester I

(MZO 101) Paper I: Biosystematics and Taxonomy	(MZO 102) Paper II: Structure and Functions in Invertebrates
(MZO 103) Paper III: Endocrinology	(MZO 104) Paper IV: Cell and Molecular Biology
MZOL 01, Lab Course I: Based on Paper I and II	MZOL 02,Lab Course II: Based on Paper II I and IV

Semester II

(MZO 201) Paper I: Population Genetics and Evolution	(MZO 202) Paper II: Reproductive Biology
(MZO 203) Paper III: Tools and Techniques in Biology	(MZO 204) Paper IV: Environmental Physiology
MZOL 03, Lab Course I: based on paper I and II	MZOL 04, Lab Course II: Based on paper III and IV

Semester III:

(MZO 301) Paper I: Comparative Anatomy of Vertebrates	(MZO 302) Paper II: Biostatistics
(MZO 303) Paper III: Ichthyology	(MZO 304) Paper III B: Animal Behaviour
MZOL 05, Lab Course I: Based on Paper I and II	MZOL 06, Lab Course II: Based on Paper III and IV

Semester IV:

(MZO 401) Paper I: Insect Biology	(MZO 402) Paper II: Animal Physiology
(MZO 403) Paper III: Population Ecology	(MZO 404A) Paper IV A: Fisheries and Aquaculture (Elective)
(MZO 404B) Paper IV B: Parasitology (Elective)	(MZO 404C) Paper IV C: Economic Zoology (Elective)
(MZO 404D) Paper IV C: Sericulture (Elective)	
MZOL 07, Lab Course I: Based on Paper I, II and III	MZOL 08, Lab Course II: Project Work
Any one elective course to be selected as paper IV	

Project Work: A project work to be done by each student based on theoretical and experimental works under allotted supervisor from the department. The project work shall be initiated at the beginning of semester IV.

Evaluation of Project work: The project report shall be submitted to the department with duly signed by the supervisor and the Head of the institution within stipulated time. Evaluation of the projects shall be done by external examiner through power point presentation by the students.

The Syllabus for M. Sc. Zoology is hereby approved for the sessions 2023 -24 and 2024-25

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....

GENERAL INSTRUCTIONS FOR STUDENTS

1. The candidate has to obtain minimum 20% marks in each theory paper and internal assessmentseparately.
2. The candidate has to secure minimum 36% marks as an aggregate in order to pass that semesterexamination.
3. The internal assessment shall include class test, home assignment and seminar presentation.
4. In internal assessment, the marks taken into consideration will be the average of two tests (i.e. theclass test and the home assignment) for each paper and shall of 20 marks.
   a. The seminar shall be in lieu of class test and home assignment combined and shall be of 20marks.
   b. There shall be one seminar in each semester.
   c. The marking of seminar shall be in terms of hard copy submission (10 marks) and presentationand open discussion (10 marks).

DIRECTIVES FOR STUDENTS, FACULTY AND EXAMINERS

1. There shall be three sections (Section A, B, and C) in each theory paper.
2. Section A shall contain very short answer type questions (One or two line answer) or objective typequestions (fill in the blank, not multiple choice questions).
3. Section B shall contain short answer type questions with the limit of 250 words.
4. Section C shall contain long answer/ descriptive type questions. The students are required to answerprecisely and the answer should not exceed the limit of 450 words.
5. The students are required to study the content mentioned in the curriculum exhaustively.

EVALUATION PATTERN

- Theory 80 marks = 04 Credits

Question Pattern	Unit I	Unit II	Unit III	Unit IV
Very short answer type questions. (2 Questionsfrom each Unit without internal choice). Maximum in two sentences.	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks
Short answer type question. Attempt one question from each unit with internal choice Word limit200-250	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks
Long answer type question. Attempt one question from each unit with internal choice. Word limit400-450	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks

Internal Assessment 20 marks = 01 credit

- Unit test – One class test in each theory paper comprising 20 marks. (containing two short answer type questions of 05 marks each and 05 objective type questions of 10 marks).
- Home assignments – Two long answer type questions from each theory paper containing 10 marks each. The answer should be prepared with the help of standard reference books. (The titles of those books, authors, year of publication and publishers details should be mentioned in an appropriate way, at the end of each assignment).
- Seminar presentations (Power point) – Comprising 20 marks.

  Each student has to be prepare one seminar in each semester. The marking of seminar shall be in terms of hard copy submission (10 marks) and presentation and open discussion (10 marks).

- Practical 200 marks = 08 credits

Two practicals of 100 marks each

CREDIT ALLOTMENTS

- Theory Paper = 05 credits (04+01)
- Practical = 04/ 08 credits

TOTAL CREDITS/ SEMESTER

- Science Subjects with 04 theory papers (100 each) and one /two practical (100 each) 20+08 =28 credits
- Science Subjects with 05 theory papers (no practical-Maths) – 25 credits
- Arts Subjects with 04 theory papers – 20 credits
- Arts Subjects with 05 theory papers – 25 credits
- Commerce subject with 05 theory papers – 25 credits

TOTAL CREDITS / PROGRAMME

- 16 Theory + 08 Practical + Project work – 80 + 32 + 08 = 120 credits
- 20 Theory – 100 credits (Maths)
- 20 Theory – 100 credits (Arts and Commerce)
- 16 Theory – 80 credits (Arts)

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....

DEPARTMENT OF ZOOLOGY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
Approved syllabus for M. Sc. ZOOLOGY by the members of Board of Studies for the Sessions 2023-24

Syllabus and Marking Scheme for Semester - II (2023 - 24)

Paper No.	Course Code/ Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	MZO 201/POPULATION GENETICS AND EVOLUTION	80	16	20	04	05
II	MZO 202/REPRODUCTIVE BIOLOGY	80	16	20	04	05
III	MZO 203/TOOLS AND TECHNIQUES IN BIOLOGY	80	16	20	04	05
IV	MZO 204/ENVIRONMENTAL PHYSIOLOGY	80	16	20	04	05
	MZOL 03, Lab Course I POPULATION GENETICS AND EVOLUTION, REPRODUCTIVE BIOLOGY	100	33			04
	MZOL 04, Lab Course II TOOLS AND TECHNIQUES IN BIOLOGY ENVIRONMENTAL PHYSIOLOGY	100	33			04
	Total	520		80		28

04 Theory papers	-	320
04 Internal Assessment	-	80
02 Practical	-	200
Total Marks	-	600
Credits	-	28

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
M. Sc. ZOOLOGY
Semester - II
SESSION 2022-23
PAPER- I
Course Code – MZO 201
POPULATION GENETICS & EVOLUTION

Max. M.- 80
Min. M.-16

UNIT -I

- Quantifying genetic variability: Genetic variation, Allele frequencies.
- Genetic structure of natural populations: Introduction, Optimum phenotypes & selection pressure. Kinds of selection, genetic variability, Canalization, genetic homeostasis.
- Phenotypic variation: Loss of genetic variations, genetic load, genetic death, mutational & segregation loads,
- Genetic Equilibrium: Balancing selection, mutation drift balance, Mutation selection balance.

UNIT - II

- Analysis of quantitative traits: Quantitative traits and natural selections.
- Estimation of heritability: Narrow sense & Broad sense Heritability.
- Genotype environmental interactions. Phylogenetic & Biological concept of species.
- Pattern & Mechanism of Reproductive Isolation.
- Modes of speciation (Allopatric, Sympatric & Parapatric.)

UNIT - III

- Concept of Evolution: Microevolution, Mesoevolution and macroevolution.
- Theories of evolution with an emphasis on Darwinism. Emergence of Neo–Darwinism, neutraltheory of Evolution.
- Molecular Clock.
- Neo -Darwinism: Hardy - Weinberg law of genetic equilibrium.

UNIT - IV

- Modern Synthetic theory of Evolution.
- Molecular evolution: Gene evolution, gene families, Molecular drive.
- Natural selection, Mutation, Genetic drift, Migration, Meiotic-drive.
- Evolution of horse and man.

SUGGESTED READING MATERIALS - (ALL LATEST EDITION).

1. Gene & Evolution: Jha A.P. John Publication, New Delhi.
2. Evolution & Genetics: Merrel D.J. Holt rinchert & Wiston INC.

3. The Genetics & Origin of Species: Dobzhansky, Columbia University Press.
4. Evolution: Dobzhansky, Ayala F.J., Stebbins G.L. & Valentine J.M. Surjeet Publication NewDelhi.
5. Species Evolution - The Role of Chromosomal Change: King M. Cambridge University Press,Cambridge.
6. A Primer of Population Genetics - Hartl D.L. Suinaer Associates INC, Massachusetts.
7. Evolutionary Genetics: Smith J.M. Oxford University Press, NewYork.
8. Evolutionary Biology: Futuyama D.J. Suinaer Associates INC publishers, Dunderland.
9. Evolution: Strikberger M.W. Johns & Bartett Publishers, Boston London.

Course Outcomes

After successful completion of these courses the student would be able:

- To gain command on genetic structure and phenotypic variation in natural population.
- To quantify different genetic problems.
- To explain the evolutionary concepts and theories, molecular clock and its significance and test thegenetic equilibrium in a population using Hardy-Weinberg Law.
- To understand the basic concepts and theories of Lamarck and Darwin.
- To comprehend concepts like modern synthetic evolution while appreciating evolutionary laws ofnatural selection, genetic drift, migration and meiotic drive.
- To explain how the molecular record provides evidence for evolution.

EVALUATION PATTERN

- Theory 80 marks = 04 Credits

Question Pattern	Unit I	Unit II	Unit III	Unit IV
Very short answer type questions. (2 Questionsfrom each Unit without internal choice). Maximum in two sentences.	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks
Short answer type question. Attempt one questionfrom each unit with internal choice Word limit 200-250	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks
Long answer type question. Attempt one questionfrom each unit with internal choice. Word limit 400-450	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks

The syllabus for Paper I (M. Sc. ZOOLOGY, Sem. - II) is hereby approved for theSession 2023 - 24

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
M. Sc. ZOOLOGY
Semester - II
SESSION 2023-24
PAPER- II
Course Code – MZO 202
REPRODUCTIVE BIOLOGY

Max. M.-80
Min. M.-16

UNIT- I

- Anatomy and histology of testis, structure and function of Leydig cell and Sertili cells.
- Spermatogenesis, Spermeogenesis and hormonal regulation..
- Structure of vertebrate sperm.
- Composition and function of seminal and prostatic fluid.
- Transportation of sperm.

UNIT II

- Anatomy and histology of ovary.
- Types of eggs in vertebrates..
- Oogenesis.
- Ovarian follicular growth, hormonal regulation of oogenesis.
- Puberty, menarchy and menopause .

UNIT III

- Fertilization and its biochemistry.
- Post fertilization events.
- Cleavage, blastula, gastrulation and fate map.
- Organogenesis in mammals.

UNIT IV

- Placentation.
- Extra embryonic membrane in mammal.
- Metamorphosis (progressive & retrogressive).
- Regeneration.

SUGGESTED READING MATERIALS - (ALL LATEST EDITION).

1. Foundation of Embryology: Bradley N.Patten, McGrow Publication.
2. Fertilization in Animal: Brain Dale, Arnold Heiniman, Gulab Vazerani Publication.
3. Developmental Biology: N.J. Berril, Tata McGrow Hill Publication N. Delhi.
4. Embryology of Vertebrates: Nelson.
5. Developmental Biology: Dr. K.V. Sastry, Dr. Vineeta Shukla, Rastogi Publications, Meerut.

Course Outcomes

After successful completion of these courses the student would be able:

- To understand the fundamentals of gametogenesis
- To gain in-depth knowledge on female hormonal coordination and control during milestone events ofthe ovarian cycle from menarch to menopause with biochemistry of fertilization
- To understand the basic concepts of post fertilization and organogenesis in mammals
- To understand the stages of implantation, establishment of placenta and process of metamorphosis

EVALUATION PATTERN

➢ Theory 80 marks = 04 Credits

Question Pattern	Unit I	Unit II	Unit III	Unit IV
Very short answer type questions. (2 Questionsfrom each Unit without internal choice). Maximum in two sentences.	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks
Short answer type question. Attempt one questionfrom each unit with internal choice Word limit 200-250	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks
Long answer type question. Attempt one question from each unit with internal choice. Word limit400-450	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks

The syllabus for Paper II (M. Sc. ZOOLOGY, Sem. - II) is hereby approved for theSession 2023 - 24

Name and Signatures

Chairperson/H.O.D	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....
University Nominee	
Subject Expert	
Subject Expert	
Representative from Industry/entrepreneur	
Student representative	
Other Prof. from Science faculty	

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
M. Sc. ZOOLOGY
Semester - II
SESSION 2023-24
Paper – III
Course Code – MZO 203
TOOLS & TECHNIQUE IN BIOLOGY

Max. M.- 80
Min. M.-16

UNIT -I

Principles and uses of analytical instruments.

- Balances – different parts & uses.
- pH meter – Principle, construction, types & uses.
- Colorimeters – Principle, construction, types & uses.
- Spectrophotometer – Principle, construction, types & uses.
- Ultra centrifuge – Principle, construction, types & uses.
- Spectroflurometer– Principle, construction, types & uses.
- Radioactivity counter– Principle, construction, types & uses.

UNIT – II

Microscopy.

- Principles of light transmission,
- Phase contrast microscope – principle, construction & uses
- Fluorescence microscope – principle, construction & uses
- Transmission electron microscope(TEM) – principle, construction & uses
- Scanning Electron microscopes (SEM) – principle, construction & uses
- Immunological Techniques-ELISA and RIA

Biosensors –

- Types and applications.

UNIT-III

Separation techniques in biology:-

- Chromatography – Principle, process (method) & uses of Paper, Thin layer & Ion Exchangechromatography.
- Gel Electrophoresis – Principle, process (method) & uses.
- Centrifugation – Principle, process (method) & uses of Density gradient centrifugation and Unitgravity centrifugation.
- Flow cytometry – Principle, process (method) & uses

UNIT – IV

Cell culture -

- Culture media –NAM and PDA ,
- Cell harvesting methods,
- Cell proliferation measurements.

Sterilization techniques –

- Chemical and physical methods of sterilization

- Principle, Construction and Uses of Autoclave and Laminar Air Flow

Cryopreservation –

- different process & uses.

Basic concept and application of Remote sensing and GIS in biology.

SUGGESTED READING MATERIALS - (ALL LATEST EDITION).

1. Practical Biochemistry: Wilson & Walker, Cambridge University Press, Cambridge.
2. Text book of Biotechnology: Chatwal G.R. Anmol publications Pvt. Ltd. New Delhi.
3. Tools of Biochemistry: Cooper T.G.
4. Microbiology: Sharma P.D. Rastogi publication, Meerut.
5. Biological Tools and Techniques (A Text Book for UG/PG Students of Life Sciences): AnantaSwargiary, Kalyani Publisher, New Delhi.

Course Outcomes

After successful completion of these courses the student would be able:

- To acquaint with techniques of sterilization, cell culture and cryopreservation as well as understandthe basic concept and application of remote sensing and GIS technology
- To understand the basic principle and uses of analytical instruments like pH meter, centrifuge andworking principle of Geiger Muller radioactivity counter
- To explain the concepts of light and electron microscopy and immunological techniques
- To understand and efficiently work with various separation techniques of chromatography and gelelectrophoresis
- To gain the skills to explain the principle and applications of various biological techniques andconcepts in biology

EVALUATION PATTERN

- Theory 80 marks = 04 Credits

Question Pattern	Unit I	Unit II	Unit III	Unit IV
Very short answer type questions. (2 Questionsfrom each Unit without internal choice). Maximum in two sentences.	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks
Short answer type question. Attempt one questionfrom each unit with internal choice Word limit 200-250	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks
Long answer type question. Attempt one questionfrom each unit with internal choice. Word limit 400-450	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks

The syllabus for Paper III (M. Sc. ZOOLOGY, Sem. - II) is hereby approved for theSession 2023 - 24

Name and Signatures

Chairperson/H.O.D	Departmental members
University Nominee	1.....
Subject Expert	2.....
Subject Expert	3.....
Representative from Industry/entrepreneur	4.....
Student representative	5.....
Other Prof. from Science faculty	6.....
	7.....
	8.....

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
M. Sc. ZOOLOGY (2023-24)
Semester – II
Paper –IV
Course Code – MZO 204
ENVIRONMENTAL PHYSIOLOGY

Max. M. - 80

Min. M.-16

UNIT – I

- Adaptation: Pre adaptation and post adaptation, Causes of adaptation, Mechanism of adaptation,
- Adaptive radiation: Adaptive radiation in mammals, Causes and Significance.
- Acclimatization.
- Mimicry and Coloration

UNIT –II

- Freshwater Adaptation in animals: Lentic habitat & Lotic habitat.
- Marine water Adaptation in animals: Benthic Region, Pelagic Region and Deep Sea Region.
- Estuaries Adaptation in animals.
- Terrestrial Adaptation in animals: Desert, arboreal, Burrowing, Cursorial & Cave.
- Aerial adaptation
- Parasitic Adaptation

UNIT –III

- Basic concept of environmental stress and strain.
- Role of hormone during stress and strain.
- Homeostasis.
- Thermoregulation (Comfort zone, body temperature, Physical, chemical and neural regulation).
- Physiological response to body exercise.

UNIT-IV

- Osmoregulation: Fresh and marine fishes and in human beings.
- Osmoregulation in human beings.
- Physiological response to oxygen deficient stress.
- Acid–base balance in mammals.
- Meditation, yoga and their effects on digestive, respiratory and endocrine system.
- Significance of body size.

SUGGESTED READING MATERIALS - (ALL LATEST EDITION).

1. Animal Physiology, Mechanism And Adaptation: Eckert, R., W.H. Freeman and Co.
2. Biochemical Adaptation: Hochachka, P.W, and Somero S.N, Princeton, New Jersey
3. Animal Physiology, Adaptation And Environment: Hochachka, P.W. and Somero S.N, Princeton,New Jersey Schiemidt Nielsen, Cambridge.
4. General & Comparative Animal Physiology: Hoar W.S. Princeton Hall of India.
5. Environmental Physiology: Willmer, P.G. Stone & Johansan I, Blackwell Science Oxford.

Course Outcomes

After successful completion of these courses the student would be able:

- To explain the concept of adaptation and acclimatization.
- To understand adaptive radiation in different aspects of terrain.
- To explain the role of hormones during stress and homeostasis.
- To understand the role of body size of organisms and effect of yoga and meditation on humanphysiology
- To understand the life processes at various environmental conditions.

EVALUATION PATTERN

- Theory 80 marks = 04 Credits

Question Pattern	Unit I	Unit II	Unit III	Unit IV
Very short answer type questions. (2 Questionsfrom each Unit without internal choice). Maximum in two sentences.	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks
Short answer type question. Attempt one questionfrom each unit with internal choice Word limit 200-250	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks
Long answer type question. Attempt one questionfrom each unit with internal choice. Word limit 400-450	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks

The syllabus for Paper IV (M. Sc. ZOOLOGY, Sem. - II) is hereby approved for the Session 2023 - 24

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....

M. Sc. ZOOLOGY (2023-24)SEMESTER – II
MZOL 03, LAB COURSE-03
(Syllabus & Scheme of Marks allotment in Practical examination)

1. Culture and controlled breeding of *Drosophilla.*
2. Study of morphological variations in drosophila.
3. Practical based on population estimation & population genetics.
4. Exercises based on evolution.
   a. Construction of phylogenetic tree.
   b. Evolutionary races of man.
5. Identification of stages of oogenesis & spermatogenesis.
6. Identification of developmental stages of gonads.
7. Identification of embryonic developmental stages in fish and frogs.
8. Study of extra-embryonic membrane in chick.
9. Identification of gametes.
10. Study of gonads (histology of testes & ovary) in vertebrates (through microtomy).

EXAMINATION SCHEME

S.NO.	EXERCISES	MARKS
1.	Experiment Based on Population Genetics	20
2.	Exercise Based on Evolution	15
3.	Exercise Based on Reproductive Biology	20
4.	Microtomy	10
5.	Viva	15
6.	Sessional	20
	Total	100

Course Outcomes

After successful completion of these courses the student would be able:

- To explain the genetic structure and phenotypic variation in natural population.
- To comprehend the basic concepts of reproductive biology through hands-on experiments.
- To explain the evolutionary concepts and theories.
- To familiar with microtomy technique.
- To understand the basic concepts of post fertilization and organogenesis in mammals

M. Sc. ZOOLOGY (2023-24)
SEMESTER – II
MZOL04, LAB COURSE-04
(Syllabus & Scheme of Marks allotment in Practical examination)

- Applications of following equipment in biological techniques:
  ph meter, colorimeter/spectrophotometer, chromatography (paper & thin layer), centrifuge and microscope.
- Media preparation.
- Sterilization.
- Culture of bacteria.
- Determination of Blood Pressure under normal and stressed condition.
- Quantitative estimation of Glucose Level in Blood.
- Oxygen consumption of animals under stress.

EXAMINATION SCHEME

S.NO.	EXERCISE	MARKS
1.	Two experiments based on tools andtechniques	20
2.	Types of microscopes.	05
	Exercise based on media preparation, sterilization and culturetechniques.	10
3.	Two exercises based on environmental Physiology	30
4.	Viva	15
5.	Sessional	20
	Total -	100

Course Outcomes

After successful completion of these courses the student would be able:

- To acquaint with techniques of sterilization, cell culture and cryopreservation as well as understandthe basic concept and application of remote sensing and GIS technology
- To acquire skills on demonstration of analytical instruments like pH meter, centrifuge, colorimeterand Spectrophotometer.
- To explain the concepts of light and electron microscopy and immunological techniques
- To efficiently work with various separation techniques of chromatography and gel electrophoresis
- To understand the life processes at various environmental conditions.

The syllabus for lab. Course M. Sc. ZOOLOGY, Sem. - II is hereby approved for thesessions 2023 - 24

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....

GENERAL INSTRUCTIONS FOR STUDENTS

1. The candidate has to obtain minimum 20% marks in each theory paper and internal assessmentseparately.
2. The candidate has to secure minimum 36% marks as an aggregate in order to pass that semesterexamination.

3. The internal assessment shall include class test, home assignment and seminar presentation.
4. In internal assessment, the marks taken into consideration will be the average of two tests (i.e. theclass test and the home assignment) for each paper and shall of 20 marks.
   a. The seminar shall be in lieu of class test and home assignment combined and shall be of 20marks.
   b. There shall be one seminar in each semester.
   c. The marking of seminar shall be in terms of hard copy submission (10 marks) and presentationand open discussion (10 marks).

DIRECTIVES FOR STUDENTS, FACULTY AND EXAMINERS

1. There shall be three sections (Section A, B, and C) in each theory paper.
2. Section A shall contain very short answer type questions (One or two line answer) or objective typequestions (fill in the blank, not multiple choice questions).
3. Section B shall contain short answer type questions with the limit of 250 words.
4. Section C shall contain long answer/ descriptive type questions. The students are required to answerprecisely and the answer should not exceed the limit of 450 words.
5. The students are required to study the content mentioned in the curriculum exhaustively.

EVALUATION PATTERN

Theory 80 marks = 04 Credits

Question Pattern	Unit I	Unit II	Unit III	Unit IV
Very short answer type questions. (2 Questionsfrom each Unit without internal choice). Maximum in two sentences.	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks	2X2 = 4 Marks
Short answer type question. Attempt one question from each unit with internal choice Word limit200-250	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks	1X4 = 4 Marks
Long answer type question. Attempt one question from each unit with internal choice. Word limit400-450	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks	1X12 = 12 Marks

Internal Assessment 20 marks = 01 credit

- Unit test – One class test in each theory paper comprising 20 marks. (containing two short answer type questions of 05 marks each and 05 objective type questions of 10 marks).
- Home assignments – Two long answer type questions from each theory paper containing 10 marks each. The answer should be prepared with the help of standard reference books. (The titles of those books, authors, year of publication and publishers details should be mentioned in an appropriate way, at the end of each assignment).

- Seminar presentations (Power point) – Comprising 20 marks.

  Each student has to be prepare one seminar in each semester. The marking of seminar shall be in terms of hard copy submission (10 marks) and presentation and open discussion (10 marks).

➢ Practical 200 marks = 08 credits

Two practicals of 100 marks each

CREDIT ALLOTMENTS

- Theory Paper = 05 credits (04+01)
- Practical = 04/ 08 credits

TOTAL CREDITS/ SEMESTER

- Science Subjects with 04 theory papers (100 each) and one /two practical (100 each) – 20 + 08 =28 credits
- Science Subjects with 05 theory papers (no practical-Maths) – 25 credits
- Arts Subjects with 04 theory papers – 20 credits
- **Arts Subjects with 05 theory papers – 25 credits**
- **Commerce subject with 05 theory papers – 25 credits**

TOTAL CREDITS / PROGRAMME

- 16 Theory + 08 Practical + Project work – 80 + 32 + 08 = 120 credits
- 20 Theory – 100 credits (Maths)
- 20 Theory – 100 credits (Arts and Commerce)
- 16 Theory – 80 credits (Arts)

The syllabus (M. Sc. ZOOLOGY, Sem. - II) is hereby approved for the session 2023 – 24

Name and Signatures

Chairperson/H.O.D ..... University Nominee ..... Subject Expert ..... Subject Expert ..... Representative from Industry/entrepreneur ..... Student representative ..... Other Prof. from Science faculty	Departmental members 1..... 2..... 3..... 4..... 5..... 6..... 7..... 8.....