INSTITUTE OF ADVANCED STUDIES IN EDUCATION
(DEEMED TO BE UNIVERSITY)

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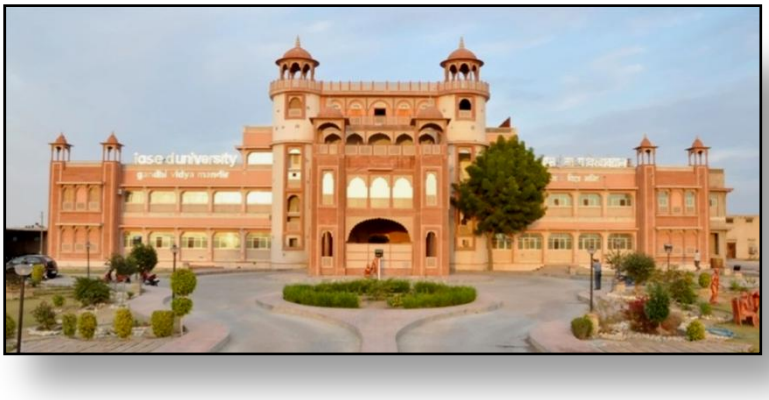
SYLLABUS MANUAL
FOR
MASTER OF SCIENCE IN ZOOLOGY

FACULTY OF SCIENCES
CHOICE BASED CREDIT SYSTEM (CBCS)
Session 2022-2024



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DEPARTMENT OF ZOOLOGY

FACULTY OF SCIENCES

About the Department:

The aim of the Department of Zoology is to build a solid foundation for the assimilation of zoological concepts and structures and to build zoological skills such as creative, logical and analytical thinking. Software, Zoology Lab, Science Lab are used to enhance the understanding of fundamental zoological concepts. It promotes the interest of the students in the subject by organizing the activities with their enthusiastic participation. The Department currently offers UG and PG courses for B.Sc., M.Sc. Programmes.

The Department focuses on training of the learners in zoological Sciences methodology so that they can conduct the high-level scientific research for the welfare of the society and industry. The teaching and research methodology are taught at the post-graduation level along with hands-on-training in the form of dissertation. The Department organizes conferences, workshops, seminars, debates, group discussions, webinars for enhancing the research, critical and analytical understanding of the learners. The Department also has collaboration with reputed research institutions in various research areas like classical general relativity and cosmology etc.

About the Programme:

The Master of Science in Zoology is a two year Choice Based Credit System (CBCS) Programme following the semester scheme. The Programme offers core, elective and skill courses. The students in I and II semester have to complete five core courses in each semester and one skill course. In III semester students have to complete three core courses and have to opt three elective courses and one skill course. In IV semester students have to complete for three core courses and have to opt three elective courses. The students have an opportunity to select elective courses from intra-department and inter-department and intra/inter-faculty for skill courses

Programme Code: MSZ (Master of Science in Zoology).

Programme Outcomes of PG in Zoology:

On the completion of the M.Sc. (Zoology) Programme, the students will be able to:

Programme Outcomes (POs)	
PO1	Apply knowledge of Zoology, in all the fields of learning including higher research and its extensions.
PO2	Innovate, invent and solve complex zoological problems using the knowledge of pure and applied Zoology.
PO3	To inculcate and develop zoological aptitude and the ability to think abstractly in the student.
PO4	To train students to apply their theoretical knowledge to solve problems.
PO5	To encourage the use of relevant software such as Zoology Lab, ZOOLOGY, and Science Lab, etc to solve problems.
PO6	To provide qualitative education through effective teaching learning processes by introducing projects, participative learning and latest software tools.
PO7	To inculcate innovative skills, team work, ethical practices among students so as to meet

	societal expectations.
PO8	To encourage collaborative learning and application of zoology to real life situations.
PO9	To inculcate the curiosity for zoology in students and to prepare them for future research.
PO10	The student shall acquire capability to evaluate hypothesis, methods and evidence within their proper contexts in any situation.
PO11	Getting Abilities Demonstrate the ability to conduct research independently and pursue higher studies towards Ph.D. degree in zoology.
PO12	Numerical Techniques The student will be able to learn some useful approximation and interpolation techniques in Zoology.

Program Specific Outcomes (PSOs):

Programme Specific Outcomes	
PSO1	To develop problem-solving skills and apply them independently to problems in pure and applied zoology.
PSO2	To assimilate complex zoological ideas and arguments.
PSO3	To improve your own learning and performance.
PSO4	To develop abstract zoological thinking.
PSO5	Communicate zoological ideas effectively, in writing as well as orally.
PSO6	Have sound knowledge of zoological modeling, programming and computational techniques as required for employment in industry.
PSO7	Apply the knowledge of zoological concepts in interdisciplinary fields.
PSO8	Model the real-world problems into mathematical equations and draw the inferences by finding appropriate solutions.
PSO9	Identify challenging problems in zoology and find appropriate solutions.
PSO10	Qualify national level tests like NET/JRF/GATE etc.
PSO11	Evaluate hypotheses, theories, methods and evidence within their proper contexts.
PSO12	Recognize the need to engage in lifelong learning through continuous education, and research leading to higher degrees like PhD, D.Sc. etc.

Admission Procedure(s):

The details of the eligibility conditions and admission procedures are given in the admission forms and on the university website. The admission will be granted on the basis of merit as per University Bye-Laws. Reservation for SC, ST, PH, OBC, EWS etc. will be granted as per IASE (Deemed to be University) Bye-Laws adhering to Government rules.

Attendance Clauses:

1. For regular candidates in the Faculties of Sciences, the minimum attendance requirement shall be such that a candidate must have attended at least 75% of the lecturers delivered and tutorials held taken together as well as 75% of practical and CCA from the date of his/her admission.
2. Condonation for the shortage of attendance:

   The shortage of attendance up to the limits specified below may be condoned on valid reason(s):

i) Up to 6%, each subject plus 5 attendances in all the aggregate subjects/papers may be condoned by the Vice-Chancellor on the recommendation of the Head of the Department for the Post-graduate classes.

ii) The Scout, NSS, and NCC cadets sent out to parades and camps and such students who are deputed by the University to take part in games, athletics or cultural activities may, for purpose of attendance, be treated, as present for the days of their absence in connection with the aforesaid activities and that period shall be added to their subject wise attendance.

Guidelines for Choice Based Credit System:

Definition clauses:

1. **Academic Year**: Two consecutive (one odd + one even) semesters constitute one academic year.
2. **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed elective and skill courses. A student needs to select **elective course** offered by the Departments and SWAYAM/MOOCs course of the same credit in which he/she is doing core courses. This shall be part of the core Programme during the third and fourth semesters. Each student has to complete **two skill courses** offered by the departments/faculties/any other institution(s). The students can choose the elective courses inter-department and skill courses from any other institution(s), inter-department, inter-faculty as well.
3. **Course**: Usually referred to, as 'papers' is a component of a Programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/ project work/ self-study etc. or a combination of some of these.
4. **CCC stands for 'Core Course Code' and ECC for Elective Course Code.**
5. **Credit Based Semester System (CBSS)**: Under the CBSS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.
6. **Credit Point**: It is the product of grade point and number of credits for a course.
7. **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one period of teaching (lecture or tutorial) or two periods of practical work/field work per week. Here one period normally equals to 50 minutes.
8. **Cumulative Grade Point Average (CGPA)**: It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in

various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

9. **ESE** stands for '**End Semester Examination'** i.e. Even Semester &**SEE for 'Semester End Examination' i**.e. odd semester.
10. **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.
11. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.
12. **Programme**: An educational programme leading to award of the Postgraduate Degree in the Core subject he/she is pursuing.
13. **Semester Grade Point Average (SGPA)**: It is a measure of performance of work done in a semester. It is a ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.
14. **Semester**: Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to November/ December and even semester from December/January to May.
15. **Skill Development Course(s) Resources**: The University may develop a provision for skill development course(s) by appointment, engagement, contract services of the resources; (human, institutional) at inter-department, intra-department, intra-faculty, inter-faculty, in this University or with any other University, institution of Research, institution of Technical Expertise, Professional and institution engaged in industrial activities for academic or/and technical development of skill.
16. **Transcript or Grade Card or Certificate:** Based on the grades earned, a statement of grades obtained shall be issued to all the registered students after every semester. This statement will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester along with statement of marks.

Grades and Grade Points: Methods to Ascertain

S. No.	Letter Grade	Meaning	Grade Point
1	'O'	Outstanding	10
2	'A+'	Excellent	9
3	'A'	Very Good	8
4	'B+'	Good	7
5	'B'	Above Average	6
6	'C'	Average	5
7	'P'	Pass	4
8	'F'	Fail	0
9	'Ab'	Absent	0

i) A student obtaining Grade F in a course shall be considered failed and will be required to reappear in the University End Semester Examination.

ii) For non-credit courses (Skill Courses) 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA

Grade Point assignment:

= and > 95 % marks Grade Point 10.0
90 to less than 95 % marks Grade Point 9.5
85 to less than 90 % marks Grade Point 9.0
80 to less than 85 % marks Grade Point 8.5
75 to less than 80 % marks Grade Point 8.0
70 to less than 75 % marks Grade Point 7.5
65 to less than 70 % marks Grade Point 7.0
60 to less than 65 % marks Grade Point 6.5
55 to less than 60 % marks Grade Point 6.0
50 to less than 55 % marks Grade Point 5.5
45to less than 50 % marks Grade Point 5.0
40 to less than 45 % marks Grade Point 4.5
36 to less than 40 % marks Grade Point 4.0

Computation of SGPA and CGPA:

(i) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student, i.e.

$$\textbf{SGPA}(S_i) = \Sigma(C_i \times G_i)/\Sigma C_i$$

where C_i is the number of credits of the ith course and G_i is the grade point scored by thestudentinthe ithcourse.

(ii) TheCGPAisalsocalculatedinthesamemannertakingintoaccountallthecoursesundergonebyastud

entoverallthe semesters of a Programme, i.e.

$$\textbf{CGPA} = \Sigma(C_i \times S_i)/\Sigma C_i$$

where$S_i$istheSGPAoftheithsemesterand$C_i$isthetotalnumberofcreditsinthatsemester.

(iii) TheSGPAandCGPAshallberoundedoffto2decimalpointsandreported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts:

(i) Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point
Course1	4	A	8	4x8=32
Course2	4	B+	7	4x7=28
Course3	4	O	10	4x10=40
Course4	4	C	5	4x5=20
Course5	4	A+	9	4x9=36
Course6	4	P	4	4x4=16
	24			172

Thus, SGPA =172/24 =7.16

Illustration for CGPA

	Semester-I	Semester-II	Semester-III	Semester-IV
Credit	**24**	**24**	**24**	**24**
SGPA	**7.25**	**7.25**	**7**	**6.25**

Thus, CGPA=(24x7.25+24x7.25+24x7+24x6.25)/96
=666/96
=6.93

Skill courses (Non credit):

The Department of Mathematics shall offer skill development courses. The skill development courses are offered by the department, or/and sustainable development courses offered by the department/faculty/any other institution(s).

Instructions for Distribution of Periods:

In view of the course content, the Department of Zoology distributed the Periods between Theory/Tutorial/Practical's mentioned in course structure:

(i) L-T-P : 4-0-0, Means four lectures/week only (no tutorial and no practical) for theory.

(ii) L-T-P : 0-0-2, Means one practical of two periods/week only for Lab course.
Where L stands for lecture, T for tutorial and P for practical

The Duration of the Period shall be fifty minutes. In each of these combinations, the first value stands for the same number of lecture instructions per week.

Medium of Instructions:

The medium of instructions for courses will be bilingual (Hindi and English).

Medium of Examinations:

Candidates are allowed to use only English medium for answering question papers in examinations.

Marking Scheme of Examination (SEE and ESE):

Type of Exam/Assessment	Semester	Maximum Marks Allotted	Duration	Type of Questions/Evaluation Methods
End Semester Examination (ESE)	**Even Semester (II and IV)**	**70**	**3 hours**	**Subject Specific 100 MCQ. MCQ stands for Multiple Choice Question which has 4 options with only 1 correct answer.**
Semester End Examination (SEE)	**Odd Semester (I and III)**	**70**	**3 hours**	**Subject Specific 100 MCQ. MCQ stands for Multiple Choice Question which has 4 options with only 1 correct answer.**
Continuous Comprehensive Assessment (CCA)	**Throughout Every Semester**	**30**	**-**	**Refer to Table A**
Skill Development Courses	**Once in II semester; Once in III semester**	**-**	**-**	**Project Work and presentation**

Table A:

SR. NO.	CCA: COMPONENT	MAXIMUM MARKS
1	Monthly test	**20X3 Test = 60**
2	Quizzes and Assignments	**10**
3	Viva-voce	**10**
4	Seminar/Symposia	**10**
5	Report writing	**10**
6	Workshop	**10**
7	Review of literature	**10**
8	Creativity/Innovation	**10**
9	Experimental Skill	**10**
10	Co-curricular activity	**10**
11	Attendance	**10**
EXPLANATION (METHOD TO ASCERTAIN MARKS FOR CCA): CCA will be reduced to 30 marks. Formula: Marks obtained/Total marksX30. For example: 60 divided by160X30 = 11.25 **PROVISO-I:** Provided that a candidate shall be granted a relaxation in the form of exemption from CCA		

component. However, the said exemption must not be provided in more than 3 components in a respective course.

PROVISO-II: Provided further that this will be mandatory for a candidate to appear in the monthly test conducted in the respective course.

Attendance in Lectures, Tutorials and Practical

Percentage	Marks Allotted
75% to 80%	02
81% to 85%	04
86% to 90%	06
91% to 95%	08
Above 96%	10

Evaluation of Practical/Lab/Projects/Dissertation:

Practical: Zoological Lab for practical Analysis			
1.	Daily Evaluation of Practical Records/Viva-Voce	10	Internal Evaluation (30 Marks)
2.	Seminar/Presentation	10	
3.	Attendance	10	
4.	Final Practical Performance and Viva-Voce	70	External Evaluation (70 Marks)
Total		100	Marks may be rounded off to nearest integer.
Project Works/Dissertation			
1.	Project Report Evaluation	70	Evaluation by two Examiners (one internal and one external)
2.	Project Presentation and Viva-Voce	30	

Skill Development Course Evaluation: Based on the performance of students and hands-on practice, the respective department/faculty where the students have completed the skill course, will declare the result as "satisfactory" or "unsatisfactory". The students have to secure two satisfactory declarations for the course completion from the respective department/faculty.

SWAYAM/MOOCs Course Evaluation (for Elective Course): The students have to opt for only those SWAYAM/MOOCs courses which are relevant to the subject and have the same credit points as offered in the course. The students have to pass the exam and earn the certificate.

Declaration of Result:

- **i.** A student acquiring minimum of 40% in the total CCA is eligible for the next semester
- **ii.** The student of I and II semester will be promoted to III semester only when s/he has cleared more than 50% or more courses including non-credit skill courses.
- **iii.** Both grading and marks system will be adopted reflecting the same in the grade cum mark card (i.e. statement of marks)
- **iv.** A student who does not pass the examination (ESE+SEE) in any course(s) or remains absent will be considered as 'FAIL' and permitted to appear in such course(s) in subsequent ESE and/or SEE or when the course is offered next time.

v. A student who fails in one or more courses in a semester shall get three more chances to complete the same, after that the student is not eligible for the post-graduate programme. The students have to pay additional examination fees for the same.

vi. Students have an opportunity to improve the credit with two additional chances. The credit obtained in the improvement examination will be final. The students have to pay additional examination fees for the same.

vii. The university shall try to ensure to declare the result within a period of 20 days from the date of the completion of the examination and upload the same on the website of the university.

Grievance Redressal Mechanism:

a) The students will have the right to make an appeal against any component of evaluation. Such appeal has to be made to the Head of the Department concerned as the case may be, clearly stating in writing the reason(s) for the complaint / appeal.

b) The appeal will be assessed by the Chairman and he/she shall place it before the **Grievance Redressal Committee (GRC),** chaired by the Dean concerned, comprising of theHOD of the concerned Department and if needed Course Teacher(s) be called for suitable explanation; GRC shall meet at least once in a semester and prior to CCA finalization.

c) The Committee will consider the case and may give a personal hearing to the appellant before deciding the case. The decision of the Committee will be final and binding.

d) The online and offline grievance reporting form is available.

e) The grievance is to be redressed within 14 working days.

COURSE STRUCTURE

Courses	No. of Courses	Semester	Lecture (L)	Tutorial (T)	Practical (P)	Total Teaching Hours	Total Marks	Total Credits
Core Course (CC)	10	I and II	24	10	06	520	1000	36
	6	III and IV	12	6	06	312	600	20
Elective Course (EC)	6	III and IV	12	6	06	312	600	20
Skill/Sustainable Development Course (SC)	2	II and III.	06	02	0	78	200*	Non-Credit
Total	24	I,II,III,IV	54	24	18	1222	2200	76

SEMESTER WISE COURSE STRUCTURE

Semester-I										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**SEE**	**CCA**	**Total**	
Core Courses	**MSZ-101**	TAXONOMY & INVERTEBRATE PHYLOGENY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ -102	BIOLOGICAL CHEMISTRY & IMMUNOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ -103	MOLECULAR BIOLOGY & CYTOGENETICS	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ -104	EVOLUTION	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP -105	Practical Work Based on Paper 101 to 104	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Total			**260**	**12**	**4**	**3**	**350**	**150**	**500**	
Total Credits for Semester-I										**18**
***Excluded in total**										

Semester-II										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**ESE**	**CCA**	**Total**	
Core Courses	**MSZ-201**	STRUCTURE AND FUNCTIONS IN INVERTEBRATE	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-202	PHYSIOLOGY IN INVERTEBRATES	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-203	BIOTECHNIQUES & MOLECULAR EVOLUTION	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-204	STATISTICAL METHODS IN BIOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-205	Practical Work Based on Paper 201 to 204	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Skill Course	**MSZ-206SC**	Biochemistry of Zoology	**39**	**3**	**1**	**0**	**70***	**30***	**100***	*****
Total			**299**	**15**	**5**	**3**	**350**	**150**	**500**	**18**
Total Credits for Semester-II										**18**
***Excluded in total**										

Semester-III										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**SEE**	**CCA**	**Total**	
Core Courses	**MSZ-301**	CHORDATA	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-302	ANIMAL BEHAVIOUR	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-303	PRACTICAL WORK BASED ON PAPER 301 AND 302	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Elective Courses	**MSZ-304 (**)**	**Elective-1**	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-305 (**)	**Elective-2**	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-306	**Elective-3 (Practical based on Elective 1&2)**	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Skill Course	**MSZ-307SC**	**Teaching Technology and Research Methodology in Zoology and Service Learning**	**39**	**3**	**1**	**0**	**70***	**30***	**100***	*****
Total			**351**	**15**	**7**	**6**	**420**	**180**	**600**	**20**
Total Credits for Semester-III										**20**
***Excluded in total**										

Semester-IV										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**ESE**	**CCA**	**Total**	
Core Courses	**MSZ-401**	DEVELOPMENTAL BIOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-402	ANIMAL ECOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-403	PRACTICAL WORK BASED ON PAPER 401 AND 402	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Elective Courses	**MSZ-404*** **	Elective-4	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-405* **	Elective-5	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-406* **	**Elective 6 (Practical based on Elective 4&5)**	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Total (*Excluded in total)			**455**	**12**	**6**	**6**	**420**	**180**	**600**	**20**
Total Credits for Semester-IV										**20**
Programme Grand Total of Credits										**76**

FIRST SEMESTER

Semester-I										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**SEE**	**CCA**	**Total**	
Core Courses	**MSZ-101**	TAXONOMY & INVERTEBRATE PHYLOGENY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ -102	BIOLOGICAL CHEMISTRY & IMMUNOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ -103	MOLECULAR BIOLOGY & CYTOGENETICS	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ -104	EVOLUTION	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP -105	Practical Work Based on Paper 101 to 104	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Total			**260**	**12**	**4**	**3**	**350**	**150**	**500**	
Total Credits for Semester-I										**18**
***Excluded in total**										

M.Sc.(Zoology) SEMESTER I			
Course Code:	**MSZ-101**	Course Type :	Core Course-01
Course Title :	**TAXONOMY & INVERTEBRATE PHYLOGENY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	1. A study of the classification of Invertebrates with distinguishing features and examples of various subdivisions. 2. Introduction to the science of taxonomy, rules of nomenclature. 3. Principles of classification: Theories of biological classification and their history; the species category; the polytypic species; population systematic; intra specific categories. 4. Methods of classification: taxonomic collection and the processes of identification, taxonomic characters: types of variations (qualitative and quantitative) within a single population, methods of arriving at taxonomic divisions on species level; preparation and use of taxonomic keys. 5. Cytotaxonomy: Importance of cytology and genetics in taxonomy
UNIT-2 Teaching Hours (13)	1. Criteria for phylogenetic interrelationship between Invertebrate phyla 2. Origin of Multicellularity(Protozoa, parazoa and metazoan) 3 Origin of radiata (Coelenterata and Ctenophora) 4.Origin of Bilateria from radiata(Importance of Planula larva and Ctenophores) 5. Phylogenetic significance of Rhynchocoela
UNIT-3 Teaching Hours (13)	1 Interrelationship of the Pseudocoelomate groups with special reference to Rotifera, Gastrotricha, Kinorhynca, nematomorpha and Entoprocta. 2 Affinities and evolutionary significance of the unsegmented lesser protostome Phyla (Priapulida, Echiuroidea and Sipunculoidea. Echiurida and Sipunculida). 3 Phylogenetic relationship between the coelomate phyla (Annelida, Onychophora, Arthropoda and Mollusca).
UNIT-4 Teaching Hours (13)	1. Affinities and evolutionary significance of the Lophophorate colelomate phyla (Brachiopoda, Phoronida and Ectoprocta). 2. Affinities of the invertebrate deuterostome phyla(Chaetognatha, Echinodermata, Pogonophora and Hemichordata)
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings	1. Avise, J.C.Molecularmarkers.NaturalHistoryandEvolution.ChapmanandHall.NewYork. 2. Barnes ,R.D. Invertebrate Zoology, W.B.Saunders Co.Philadelphia. 3. Barrington, E.J.W. Invertebrate Structureand Function.Thomas Nelsonand Sons Ltd.London. 4. Hyman,L.H.TheInvertebratessmallercoelomategroupsVolV.McGrawHillCo.NewYork. 5. HymanL.H.TheInvertebratesVol.2.McGrawHillCo.NewYork 6. Hyman, L.H. The Invertebrate Vol.8.McGrawHillCo.NewYorkandLondon. 7. Hyman,L.H.TheInvertebratesVol.I.ProtozoathroughCtenophora.McGrawHillCo.NewYork. 8. Jagerstein,G.EvolutionofMetazoalifecycle,AcademicPress,NewyorkandLondon 9. Kato, M.TheBiologyofBiodiversity,Springer 10. Mayer ,E.Elementsoftaxonomy 11. ParkerT.J.andHaswell,W.A. TextbookofZoology.MacmillanandCo.London. 12. Read,C.P.AnimalParasitism.PrenticeHallInc.NewJersy		

M.Sc.(Zoology) SEMESTER I			
Course Code:	**MSZ-102**	**Course Type :**	Core Course-02
Course Title :	**BIOLOGICAL CHEMISTRY & IMMUNOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Structure of atoms, molecules & Chemical Bonds Biophysical Chemistry : Water, Acids & Bases, Buffers, Solution, Colloidal State, Viscosity, Surface Tension, Adsorption, Isotopes Chemistry of Carbohydrates: definition, general properties, classification (Monosacharides, Disaccharides, Polysacharides) Sugar derivatives; Metabolism of carbohydrates Chemistry of Lipids: definition, general properties and classification, fatty acids: Simple and compound lipid, Steroids, metabolism of lipids, Biomedical importance of lipids.
UNIT-2 Teaching Hours (13)	Chemistry of proteins and Amino acids: definition, general properties of amino acids and proteins, Metabolism of proteins, Biomedical importance of proteins and Vitamins Chemistry of Nucleic Acids: Definition, general properties, classification and importance of Nucleic acids.
UNIT-3 Teaching Hours (13)	Enzymes: Chemistry of enzymes, Nomenclature, specificity and metabolism of enzymes, Competition and noncompetitive inhibition, Allosteric inhibition. Inborn errors of metabolism Introduction and historical background of immunology, Antigens, Antibody, antibody structure and diversity
UNIT-4 Teaching Hours (13)	MHC, mechanism of immune response. HLA class I, II, II molecules, Humeral and cell mediated immunity, Hypersensitivity reaction: type I, II, III and IV. Active and passive immunization, novel approach for various vaccines, process of vaccination, Autoimmunity: Autoimmune diseases & Transplantation.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation

Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings	1. Albertsetal. molecularBiologyofthecell,Garland 2. Barrington,EJW.GeneralandcomparativeendocrinologyOxfordClarendonPress. 3. Bentley,P.J.ComparativeAnimalendocrinology,CUP. 4. Gorbmanetal.Comparativeendocrinology.JohnWileyandsons. 5. Hadley,Endocrinology,PrenticeHall 6. Hoar'generalandcomparativephysiology,Prenticehall 7. Lodishetal.MolecularcellBiology,Freeman 8. Martin,C.R.Endocrinephysiology,OUP. 9. Nielson,S.Animalphysiology,CUP 10. ProsserandBrown.Comparativeanimalphysiology.Satishbookenterprises. 11. Williams,R.H.textbookofendocrinology.WBSaunders. 12. Gyton,sHumanphysiology 13. Ganongs.Reviewofmedicalphysiology.Langemedical 14. Vandershermann,HumanPhysiology.McGrawHill 15. Chaterjee,C.C.HumanPhysiology,Vol.IandII. 16. Mathewsetal.Biochemistry.Pearsoneducation.		

M.Sc.(Zoology) SEMESTER I			
Course Code:	**MSZ-103**	**Course Type :**	Core Course-03
Course Title :	**MOLECULAR BIOLOGY & CYTOGENETICS**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	1. History and Scope of Molecular Biology 2. Detailed structure of DNA and RNA, B-DNA,Z-DNA, Topological structure of DNA, t-RNA, micro RNA
UNIT-2 Teaching Hours (13)	DNA Replication: Process and difference between Prokaryotic and Eukaryotic DNA replication.DNA and RNA polymerase, Structure and function. Accessory proteins involved in DNA replication, regulation of replication. Protein Synthesis: Mechanism of transcription in prokaryote and Eukaryotes. Role of sigma and Rho factor in transcription, Split gene, processing of Hn-RNA(capping, tailing and splicing)Translation(Initiation complex, elongation and termination) Post and cotranslational modification
UNIT-3 Teaching Hours (13)	Gene regulation in prokaryote and Eukaryote- Lac operon, tryo operon of E.Coli, Enhancer and silencer, Non coding gene. Molecular recombination and repair of DNA- Holliday junction, rec A and other recombinase, Mobile genetic element(transposon). Integrons, retroposons, DNA repair (direct repair, nucleotide excision repair NER, base excision repair BER, Mismatch repair MMR).
UNIT-4 Teaching Hours (13)	Somatic cell genetics-cell fusion, heterokaryon Imprinting of genes Cell cycle. Cancer and Apotopsis (cell death), mitosis promoting factors MPF, Anaphase promoting factors APF, CDKs and cyclins, p53, onchogenes (SIS and RAS), tumour suppressor gene(TS)
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual 2. However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings	1. **Afherly,A.G.,J.R.GirtonandJ.F.McDonald**.TheScienceofgenetics.SaundersCollegePublishing, Harcourt Brace College,NY. 2. **Alberts,B.,D.Bray,J.Lewis,M.Raff,K.RobertsandJ.D.Watson**:Molecularbiologyofthe Cell,Garland PublishingInc.New York. 3. **Braun,Robert**:IntroductiontoInstrumentalanalysis,McGrawHillInternationaledition. 4. **Brooker,R.J**.Genetics:AnalysisandPrinciples.Benjamin/Cummings,LongmanInc. 5. **Brown,T.A(Ed):**MolecularBiologyLabFax,BiosScientificPublishersLtd.,Oxford. 6. **Dabre, P.D**., Introduction to Practical Molecular Biology, John Wiley and Sons Ltd., New York. 7. **Darnell, J.H.Lodish and D. Baltimore**: Molecular Cell Biology Scientific American Book, Inc.,USA. 8. **Fairbanks, D.J. and W.R.Anderson**.Genetics- The Continuity of Life. Brooks/Cole PublishingCompanyITP,NY,Toronto. 9. **Gardner,E.J.,M.J.SimmonsandD.P.Snustad**.PrinciplesofGenetics.JohnWileyandSons.Inc.NY. 10. **Griffiths,A.J.F.,J.H.Miller,D.T.Suzuki,R.C.LewontinandM.W.Gelbari**. An introductionto genetic analysis.W,H.FreemanandCompany,NewYork.		

M.Sc.(Zoology) SEMESTER I			
Course Code:	**MSZ-104**	**Course Type :**	Core Course-04
Course Title :	**EVOLUTION**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Theories of evolutionary thought: (a) Greek thought to Lamarck (b) Darwin and theory of evolution (c) the period after Darwin Genetic basis of Evolution: genetic and quantitative aspects of evolution; population as a unit of evolution; gene frequency; gene pool; evolution, the result of change in gene frequency; genetic equilibrium
UNIT-2 Teaching Hours (13)	Hardy Weinberg Law; Mutation pressure; selection pressure; effects of population size; random and non-random reproduction; genetic drift (Sewall-Wright effect) Variation: Somatic and germinal variations, chromosomal variations; gene mutations, rate, direction and nature of mutations, natural and induced mutations, mutagens.
UNIT-3 Teaching Hours (13)	Isolation and its role in species formation (i) Speciation; definition of species, sub-species and races; speciation a gradual or a sudden process. Allopathic and sympatric speciation. (ii) Isolating mechanisms; geographical, ecological, physiological, biochemical, anatomical, developmental, behavioral, psychological and social. (iii) Effects of Isolation: restriction of random dispersal and random mating; character displacement; reduction of fertility (iv) Failure of isolating mechanism, gene flow, migration, Heterosis
UNIT-4 Teaching Hours (13)	Adaptational diversity and nature of adaptations; adaptive radiations and occupation of new environments and niches; mimicry and coloration. Ecology and evolution. Natural selection, critical evaluation of the concepts of struggle for existence and survival of the fittest; the modern concept of natural selection's adaptation and differential reproduction; Nedarwinism and Neolamarckism. Characteristics of evolution: Extinction, replacement, irreversibility of specialization etc.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments

*** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

Selected Readings

1. Ball,MarionJ.:Whatisacomputer?,HonghtonMifflinCompany,Boston,Massachusetts, 1972'
2. Batschelet, E.Introductiontomathematics for lifescientists.SpringerVerlag,Berlin.
3. Brightman'RichardW.andJeffreyMDimsdale:Usingmicrocomputer,GalgotiaPublication Pvt.Ltd.,1987
4. Desmonde, William H: Computers and their uses, Prentice Hall, Inc., Englewood Cliffs; NewJersey,1964
5. Dobzhansky,Th.GeneticsandOriginofSpecies.Columbia UniversityPress.'
6. Dobzhansky,Th.,FJ.AyalaGLStebbinesandJ.M.Valentine.Evolution.SurjeetPublication,Delhi.'
7. Futuyama,DJ.EvolutinaryBiology,SuinuaerAssociates,INCPublishers,Dunderland.
8. Green,R.H.Samplingdesignandstatisticalmethodsforenvironmentalbiologists .John Wiley&Sons, NewYork..
9. Gupta, AmarandHoo-minD Toong:Insightintopersonalcomputers,IEEEPress,1985'
10. Hartl,D.L. APrimerofPopulationGenetics.SinauerAssociates,Inc,Massachusetts.,
11. Jha,A.P.GenesandEvolution.JohnPublication,NewDelhi.

M.Sc.(Zoology) SEMESTER I			
Course Code:	**MSZP -105**	**Course Type :**	Core Course-05
Course Title :	**Practical Work Based on Paper 101 to 104**		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

Semester I

Practical Work Based on Paper 101 to 104

Day 1

1.Invertebrates:Identification, classification & study distinguishing features of important Representatives from various groups' (Protozoa to Platyhelminthes).

2. Study of permanent prepared slides (From protozoa to Platyhelminthes).

3.Anatomy: .

(i) General Anatomy, Reproductive and Nervous Systems of Cockroach, Grasshopper Crab and Prawn.

4.Premanent Preparation and Their Study :

(i)Preparation of cultures of Amoeba, Paramaecium and Euglena; Study of these protozoans using vital dyes. - ,

(ii) Permanent preparations and study of Amoeba, Paramaecium and Euglena from cultures, Vorticella from the pond water; flagellates' from the gut of white ant and housefly, Trypansomes in the blood of house rat, lifecycle stages of Monocystis from the seminal vesicle of earthworm.

(iii) Collection and study of live Hydra, its fixation and permanent preparation.

(iii) Permanent preparations of different materials to be provided for study(Protozoa to Platyhelminthes)

5.Biologieal Chemistry: . - .

i. Identification of Protein, carbohydrates and lipid in various tissues.

ii. Identification of different kinds of mono, di and polysaccharides in biological and chemical materials.

iii. Quantitative estimation of the following by spectrophotometer and semi auto analyser methods in various tissues,

(a) Carbohydrates: glycogen and glucose.

(b) Proteins: total proteins.

(c) Lipid: Phospho1ipids and cholesterol.

(d) Nucleic acids: DNA and RNA. .

(e) Enzymes: acid and alkaline phosphatase.

6. Cell Biology:

i. Squash & smear preparations of testis of cockroach and grasshopper, Acetocarmine &' Fuelgen staining of these preparations.

ii. Study of mitosis in onion root tip and mammalian bone marrow cells.

iii. Study of giant chromosomes in the salivary gland of Chironomus larva and Drosophila.

iv. Vital and supra-vital staining (with neutral red and Janus Green B) of cells of the testis of an insect or mammal to study the mitochondria.

iv. RNA and DNA estimation.

7: Genetics:

iii. Monohybrid & Dihybrid inheritance in Drosophila.

Note: Use Of animals for dissection and practical work is subject to the conditions that these are not banned under the wildlife protection act.

DAY 2

1 Invertebrates:

	Identification, classification& study distinguishing features of important Representatives from various groups' (Annelida to Hemichordata). 2. Study of permanent prepared slides (From Annelida to Hemichordata) 3.Anatomy: (i)Identification of various local Insects up to order with the help of taxonomic keys. 4.Premanent Preparation and Their Study : (i) Collection, fixation & permanent preparations of trematodes; cestodes & nematodes found in sheep and pig in the stool of infected persons. (ii) Permanent preparation of various parts of dissection carried out of the animals (Annelida to Hemichordata) (iii) Permanent preparations of different materials to be provided for study, 5. Cell Biology: v. Preparation of multi-polar nerve cell from the spinal cord of a mammal. vi. Chromosome counts in cells of the testis of an inset or mammal or cells of the bone marrow of a mammal. . vii. Study of prepared microscopic slides, including those showing various cell types, mitosis,meiosis and giant Chromosomes. . viii. Preparation and staining of bar bodies. 6: Genetics: v. identification of blood groups in' man. . Note: Use Of animals for dissection and practical work is subject to the conditions that these are not banned under the wildlife protection act.
	PRACTICAL EXAMINATION SCHEME **BOARD FIRST: DAY FIRST DURATION 5 HRS** 1. Exercise in Biological Chemistry 15 Marks 2. Dissection 15 Marks 3. Permanent preparation 10 Marks 4 Seminar/Field/Tour report 10 Marks 5. Viva-voce 10 Marks 6. Class record 10 Marks **Total** **70 Marks** Internal Assessment 30 marks **Grand Total** **100 Marks** **BOARD SECOND: DAY SECOND DURATION 5 HRS** 1. Exercise in Cell biology 15 Marks 2 Exercise in Genetics 15 Marks 3. Exrecise in Taxonomy 10 Marks 4. Spots (5) 10 Marks 5. Viva Voce 10 Marks 6. Class record 10 Marks **Total** **70 Marks** Internal Assessment 30 marks **Grand Total** **100 Marks**

SECOND SEMESTER

Semester-II										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**ESE**	**CCA**	**Total**	
Core Courses	**MSZ-201**	STRUCTURE AND FUNCTIONS IN INVERTEBRATE	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-202	PHYSIOLOGY IN INVERTEBRATES	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-203	BIOTECHNIQUES & MOLECULAR EVOLUTION	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-204	STATISTICAL METHODS IN BIOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-205	Practical Work Based on Paper 201 to 204	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Skill Course	**MSZ-206SC**	Biochemistry of Zoology	**39**	**3**	**1**	**0**	**70***	**30***	**100***	*****
Total			**299**	**15**	**5**	**3**	**350**	**150**	**500**	**22**
Total Credits for Semester-II										**22**
***Excluded in total**										

M.Sc.(Zoology) SEMESTER II			
Course Code:	**MSZ-201**	**Course Type :**	Core Course-06
Course Title :	**STRUCTURE AND FUNCTIONS IN INVERTEBRATE**		
Credit:	1	**Hours:**	2 Hours/Week
		Total Teaching Hours:	Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Practical Examination	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	Practical Exam		
Duration	3 Hrs		

UNIT-1 Teaching Hours (6)	1. Locomotion in Invertebrate (a) Amoeboid movements: Ultra structure of cilia and flagella: Ciliary and flagellar movements; molecular and physiological mechanisms involved in the three kinds of movements (b) Myotomes and muscle fibers in invertebrate structure and their involvement in locomotory action. (c) Locomotion in relation to hydrostatics. Coelome, metamerism, arthropodization (d) An outline of flight mechanism in insects.
UNIT-2 Teaching Hours (8)	Filter feeding in higher invertebrates; Feeding mechanisms in insects and echinoderms. Respiration (a) Respiration in lower invertebrates(Protozoans to Helminthes) (b) respiration In higher invertebrates(Trachea, Gills, Lungs and Lophophores) (c) Physiology of respiratory pigments in invertebrates Excretion: Study of structural and functional organization of excretory systems in various invertebrate groups and a survey of various excretory products met within them.
UNIT-3 Teaching Hours (6)	Reproduction Asexual and sexual reproduction met within different invertebrate groups, Parthenogenesis. Larval forms met within different invertebrate group and their significance Osmoregulation and ionic regulation: Survey of principal mechanisms in fresh water, marine and terrestrial invertebrate forms.
UNIT-4 Teaching Hours (6)	Parasitism: general consideration, Types of parasites, type of hosts, symbiosis and commensalism. Protozoan parasites: Distribution, habit and habitat, structure life cycle and disease caused by selected pathogenic protozoan parasites of man. Entamoeba histolytica, Trypanosoma gambiens, Leishmania donovani and Plasmodium vivax. Helminthes parasites: General characters, organization and larval forms of Platyhelminthes and nemathelminthes. Distribution, habit and habitat, structure and life cycle of economically important helimnth parasites of man and domesticated animals: Echinococus granulosus, Hymenolapsis nana, Schistosoms haematobium, Paragonimus westermani and Trichinella spiralis.
Teaching And	1. Lecture method

<table>
<tr><td>Learning Strategies</td><td colspan="3">2. Problem Solving method
3. Graphical method
4. Seminar/Symposia
5. Review of literature
6. Report writing
7. Group Discussion
8. Videos/Animation
9. Self-Learning/e-Learning
10. Workshops/Experiments
* The teaching and learning strategies may be change as per requirement of the students and their capabilities.</td></tr>
<tr><td rowspan="13">Continuous &Comprehensive Assessment (CCA)</td><td>S. No.</td><td>CCA- Components</td><td>Max. Marks Allocation</td></tr>
<tr><td>1.</td><td>Monthly test</td><td>20*3 Test=60</td></tr>
<tr><td>2.</td><td>Quizzes and Assignments</td><td>10</td></tr>
<tr><td>3.</td><td>Viva-voce</td><td>10</td></tr>
<tr><td>4.</td><td>Seminar/Symposia</td><td>10</td></tr>
<tr><td>5.</td><td>Report writing</td><td>10</td></tr>
<tr><td>6.</td><td>Workshop</td><td>10</td></tr>
<tr><td>7.</td><td>Review of literature</td><td>10</td></tr>
<tr><td>8.</td><td>Creativity/Innovation</td><td>10</td></tr>
<tr><td>9.</td><td>Experimental Skill</td><td>10</td></tr>
<tr><td>10.</td><td>Co-curricular activity</td><td>10</td></tr>
<tr><td>11.</td><td>Attendance</td><td>10</td></tr>
<tr><td colspan="3">Total 160 marks equivalent reduced to CCA original marks 15.</td></tr>
<tr><td>Semester End Examination pattern for post graduate Programme</td><td colspan="3">NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.</td></tr>
<tr><td>Periodical Revision Of Syllabus</td><td colspan="3">1. Annual
2. However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.</td></tr>
</table>

M.Sc.(Zoology) SEMESTER II			
Course Code:	**MSZ-202**	**Course Type :**	Core Course-07
Course Title :	**PHYSIOLOGY IN INVERTEBRATES**		
Credit:		**Hours:**	3 Hours/Week
		Total Teaching Hours:	39 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (9)	Mechanism of secretion and action of all types of digestive juices met within the mammalian digestive pathway, Physiological mechanisms involved in the absorption ofthe end products of digestion, digestive glands and process of digestion, digestive disorders. Chemistry of respiration with particular reference to mammals, respiratory path, respirator pigments, ventilation, modified forms of respiration, respiratory disorders.
UNIT-2 Teaching Hours (12)	Blood, Physiology of blood clotting, heart, transport mechanism, nervous regulation of heart function in man, conductile and contractile mechanism of heart, cardiac cycle in man, ECG, regulatory mechanism of heart, circulatory disorders(hypertension, Hypotension, Anaemia, Myocardial infarction etc.) Physiology of Excretion, Muscle tissue and Nervous tissue. Various nitrogenous waste products, Kidney, Architecture of nephron, role of kidney in osmoregulation, mechanism and regulation of urine formation, disorders of excretion.
UNIT-3 Teaching Hours (9)	**Physiology of Excretion, Muscle tissue and Nervous tissue.** **Morphology and functional architecture of the contractile apparatus in muscle tissue;** **Study of the biophysical and biochemical events underling contraction and relaxation process. Muscular disorders.** **Biochemistry and molecular physiology of genesis, conduction of nerve impulse and transmission across synaptic junctions, neurotransmitters, reflex action.**

UNIT-4 Teaching Hours (9)	**Physiology of the receptor system: general mechanism involved in stimulus transduction at receptor sites: Functional architecture and stimulus processing in eye, ear and olfactory epithelium.** **Endocrine physiology: Cellular mechanisms of hormone action in target tissues (Hormone receptors, membrane receptors, nuclear receptors, G protein), Hypothalamic control of pituitary activity and phenomenon of neurosecretion; genesis types and general functions of hormones of various endocrine glands (Hypophysis, adrenal, thyroid, parathyroid, testis, and ovary, Islets of Langerhans).** **Reproduction: Endocrinological control of the testicular, ovarian and uterine functions,** **physiological aspects of implantation and parturition and lactation. Reproductive abnormalities (Gonorrhea, Syphilis, genital herpes, prostrate problems, vaginitis,Uterine tumors,menstrual complications.**
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		

Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.

M.Sc.(Zoology) SEMESTER II			
Course Code:	**MSM-203**	**Course Type :**	Core Course-08
Course Title :	**BIOTECHNIQUES & MOLECULAR EVOLUTION**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Human karyotype- Banding techniques, Human genome, Human chromosome and genetic map, chromosomal mapping, human pedigree analysis) Molecular cytogenetics- FISH, GISH, DNA finger printing, PD-Loop techniques, chromosomal painting, PCR, DNA chip and microarrays. Genome organization- C value paradox, prokaryotic genome, viral genome and eukaryotic genome.
UNIT-2 Teaching Hours (13)	Somatic cell genetics- Cell fusion and hybrids agents and mechanism of fusion; Heterokaryon- selecting hybrids and chromosome segregation. Biosensors Immunological techniques based on Ag-Ab interactions, ELISA, radioimmunoassay (RIA) Separation techniques and radioisotope and mass techniques in Biology: electrophoresis, centrifugation, MRI, Cryo-techniques, for microscopy, Freeze dying
UNIT-3 Teaching Hours (13)	DNA sequencing and genome libraries: preparation of template DNA, Automated DNA sequencing, DNA sequence storage and analysis. Animal and Human genomics: C. elegans, Drosophila genome, Mouse genome, Human genome, genome of other animals.
UNIT-4 Teaching Hours (13)	Molecular evolution: Concept of neutral evolution, molecular divergence and molecular clock, molecular tools in phylogeny, classification and identification, proteins and nucleotide sequence analysis; origin of genes and proteins, gene duplication and divergence. Genetic evidences for modern human origins-Tracing human history through mitochondrial DNA. The Neanderthal genome , another archaic huminin genome.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER II			
Course Code:	**MSZ-204**	**Course Type :**	Core Course-09
Course Title :	**STATISTICAL METHODS IN BIOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Objective and significance; important terms and symbols; graphs (bar diagrams, histograms, frequency polygon, line diagrams, pie diagram) Frequency distribution and centering constants (Mean Median and Mode) Measures of variation (Standard deviation, variance, standard error of the mean)
UNIT-2 Teaching Hours (13)	Rates and ratios. Sampling variation of proportions. Significance of difference in proportions (t-test) Chi-square test. Correlation and regression. Analysis of variance (ANOVA) Probability distributions: Binomial, Poisson and Normal
UNIT-3 Teaching Hours (13)	Mathematical Modeling (a) Types of models- statistical, empirical, mechanistic, stochastic (b) Properties of models-generality, precision, realism (C)building a model planning (Conceptualisation), implementation, evaluation, sensitivity analysis).
UNIT-4 Teaching Hours (13)	Detailed treatment of selected specific models from different areas of Biology (examples) i. Cycling of nutrients in an ecosystem/eutrophication model. ii. Optimal clutch size in birds iii. Morphogenesis iv. Genetic drift Computer application in zoological study; software used in biomedical sciences (Image analysis, system automation).
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation

<table>
<tr><td></td><td colspan="3">9. Self-Learning/e-Learning
10. Workshops/Experiments
* The teaching and learning strategies may be change as per requirement of the students and their capabilities.</td></tr>
<tr><td rowspan="13">Continuous &Comprehensive Assessment (CCA)</td><td>S. No.</td><td>CCA- Components</td><td>Max. Marks Allocation</td></tr>
<tr><td>1.</td><td>Monthly test</td><td>20*3 Test=60</td></tr>
<tr><td>2.</td><td>Quizzes and Assignments</td><td>10</td></tr>
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<tr><td colspan="3">Total 160 marks equivalent reduced to CCA original marks 30.</td></tr>
<tr><td>End Semester Examination pattern for post graduate Programme</td><td colspan="3">NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.</td></tr>
<tr><td>Periodical Revision Of Syllabus</td><td colspan="3">1. Annual
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</table>

M.Sc.(Zoology) SEMESTER II			
Course Code:	**MSZP-205**	**Course Type :**	Core Course-10
Course Title :	**Practical Work Based on Paper 201 to 204**		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

Practical Work Based on Paper 201 to 204

Day I

1 Invertebrates:
(i)Study of various larval stages of invertebrates.
(ii)Preparation of culture of protozoans and poriferans from local water bodies.
(iii) Study of sections of the arm of a starfish; water vascular system of starfish; general anatomy of a holothurian; Aristotle's lantern of a sea-urchin: complete as well as disarticulated arrangement of the parts of Aristotle's lantern.
2.Anatomy: .
(ii) Nervous system and general anatomy of Patella, Lamellidens, Mytilus, Sepia, Loligo, Octopus and Aplysia.
3.Premanent Preparation and Their Study :
(i)Permanent Preparation of various parts of molluscan body.
4. Physiology:
i. Demonstration of the use and operation of oscilloscope for recording neuro-electnc activity and electro-cardiogram.
ii. Kymographic recording of muscle twitch, summation of twitches, tonic contractions, tetanus, fatigue and staircase phenomenon from the sciatic nerve muscle reparation of rat.
iii. Kymographic recording of the rat heart beat & the study of the effect of electrical stimulation, various ligatures, drugs, etc.
iv. Study of spinal and convulsive reflexes in rat.
v.Estimation of blood pressure(Diastolic and Systolic).
5: Genetics:
i. Culture and identification of male and female Drosophila.
ii. Identification of wild and mutant forms of Drosophila.
6. Statistical Methods in Biology:
i Preparation of frequency tables and graphs.
ii. Calculation of standard deviation, variance and standard error of the mean. .
iii). Plotting the slope of a line on a graph, calculations o f the slope of a line, coefficient and regression. Students shall have to maintain a complete record of the work done. '
iv). Preparation of histogram, bar diagram and Line graph using computer.
Note: Use Of animals for dissection and practical work is subject to the conditions that these are not banned under the wildlife protection act.

SEMESTER II Practical Work Based on Paper 201 to 204
DAY 2

1.Anatomy: .
(i) Reproductive, excretory, nervous & circulatory systems of an annelids(earthworm and leech).
2.Biologieal Chemistry: . - .
i). Paper chromatography and thin layer chromatography:- uni-dimensional chromatography, using amino acids from purified samples and biological materials.
II). Paper electrophoresis and Gel (SDS page and Agarose) electrophoresis; Determination of serum protein through paper and gel (SDS and Agarose electrophoresis)
iii). Study of digestive enzymes in different parts of the alimentary canal (including salivary glands of the cockroach).
3. Physiology:
i. Study of spinal and convulsive reflexes in rat.
ii. Photometric determination of haemoglobin in blood sample.
iii. Demonstration of the following in blood: clotting time, erythrocyte sedimentation rate, haemolysis and crenation. .
iv. Determination of blood urea value.
v. Enzyme activity of LDH and SDH.
4.Cell Biology:
i.Preparation of thick and thin blood film smear.
ii. Study of PBF (Peripheral blood film).
iii.Eosinophil count in given/ own blood sample.
5: Genetics:
i. Simple problems based on Mendelism to be done by the students.
ii. Demonstration of sex chromatin.
iii. Problems based on gene interaction to be done by the students.
iv. Drosophila culture
6. Statistical Methods in Biology:
i. Calculation of probability & significance between mean using t -test.
ii. Calculation of significance using Chi-square test.
Note: Use Of animals for dissection and practical work is subject to the conditions that these are not banned under the wildlife protection act.

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		

PRACTICAL EXAMINATION SCHEME

BOARD FIRST: DAY FIRST DURATION 5 HRS

1. Dissection/ Demonstration	15 Marks
2. Exercise in Physiology	15 Marks
3. Exercise in Statistics	10 Marks
4. Permanent preparation(Lower/Higher Invertebrates)	10 Marks
5. Viva-voce	10 Marks
6. Class record	10 Marks
Total	**70 Marks**
Internal Assessment	30 marks
Grand Total	**100 Marks**

BOARD SECOND: DAY SECOND DURATION 5 HRS

1. Exercise in Cell biology	15 Marks
2 Exercise in Genetics	15 Marks
3. Permanent preparation (Genetics/ Cell Biology)	10 Marks
4. Spots (5)	10 Marks
5. Viva Voce	10 Marks
6. Class record	10 Marks
Total	**70 Marks**
Internal Assessment	30 Marks
Grand Total	**100 Marks**

M.Sc.(Zoology) SEMESTER II			
Course Code:	**MSM-206SC**	**Course Type :**	Skill Course-01
Course Title :	**Biochemistry of Zoology**		
Credit:	0	**Hours:**	3 Hours/Week
		Total Teaching Hours:	39 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination		Mid. Test	
Duration		1 Hr	

Objective:
This course is designed to provide understanding the Zoological problems in interdisciplinary subjects in particular life sciences.

Course Outcomes: On the completion of the course, the students will be able to

1. Understand the population growth models and its application to Zoological epidemiology.
2. Understand the blood flow in large and small blood vessels.
3. Understand the diffusion problem in biology.
4. Understand the Mendalh's mental theory, Equilibrium solutions.
5. Understand the flow in capillaries.
6. Identify the challenging problems in interdisciplinary subjects to solve various research problems.

UNIT-1 Teaching Hours (13)	Population growth, single spair time depend models, application to **Zoological**opidemiology, age structured models. Two and more spair model, Lotka-Voltarra models of Predator-prey relationship.
UNIT-2 Teaching Hours (13)	Biofluid dynamics, Blood flow in large and small blood vessels. Flow in capillaries, Sedimentation of red blood cells.
UNIT-3 Teaching Hours (13)	Diffusion problem in biology, Diffusion through membrane, transcapillan exchange. Solutions in simple cases.
UNIT-4 Teaching Hours (13)	Engymes Kinetics, Mendalh's mental theory, Equilibrium solutions.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60

Continuous &Comprehensive Assessment (CCA)	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings	1. Rubinov, S.L. : Introduction to Zoological Biology. 2. Kapoor, J.N.: Zoological Models in Biology and Medicines. 3. Murry, R.D.: Population Dynamics 4. Saxena, V.P.: Introduction to Biomaths, Wiley-Eastern.		

SEMESTER III

Semester-III										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**SEE**	**CCA**	**Total**	
Core Courses	**MSZ-301**	CHORDATA	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-302	ANIMAL BEHAVIOUR	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-303	PRACTICAL WORK BASED ON PAPER 301 AND 302	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Elective Courses	**MSZ-304 (**)**	**Elective-1**	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-305 (**)	**Elective-2**	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-306	**Practical based on Elective 1&2**	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Skill Course	**MSZ-307SC**	**Teaching Technology and Research Methodology in Zoology and Service Learning**	**39**	**3**	**1**	**0**	**70***	**30***	**100***	*****
Total			**351**	**15**	**7**	**6**	**420**	**180**	**600**	**20**
Total Credits for Semester-III										**20**
***Excluded in total**										

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-301**	**Course Type :**	Core Course-11
Course Title :	**CHORDATA**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Origin and outline classification of the chordates. Interrelationships of Hemichordata, Urochordata and Cephalochordata and their relations with other Deuterostomes. Life histories of sessile and pelagic tunicates and ascidian, Pyrosoma, Salpa, Doliolum and Oikopleura
UNIT-2 Teaching Hours (13)	Origin, evolution and adaptive radiation of vertebrates. (a) Geological time scale and fossils (b)Origin, evolution and general characters of Agnatha (Ostracoderms and Cyclostomes). (c) The early gnathostome (Placodermi) (d) A general account of the elasmobranchi, Holocephali, Dipnoi, Crossopterygi (e) Adaptive radiation in bony fishes. Origin, evolution and adaptive radiation of Amphibia
UNIT-3 Teaching Hours (13)	Origin and evolution of reptiles: the concept of land Seymouria and related forms: Cotylosauria, basic skull types and outline classification of reptiles. Dinosaurs, types and evolutionary significance Living reptiles- a brief account of Rhynchocephalia. Chelonia, Crocodilia and Squamata
UNIT-4 Teaching Hours (13)	A general survey of the main radiations in eutherian mammals (excluding detailed reference toindividual order) Evolution of man: relationship of man with other Primates: fossil record of Man's ancestry.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60

Continuous &Comprehensive Assessment (CCA)	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-302**	**Course Type :**	Core Course-12
Course Title :	**ANIMAL BEHAVIOUR**		
Credit:	1	**Hours:**	2 Hours/Week
		Total Teaching Hours:	26 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Practical Examination	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	Practical Exam		
Duration	3 Hrs		

UNIT-1 Teaching Hours (6)	Introduction of animal behavior Orientation (a) Classification of various types of taxes and kineses. (b)Flight mechanism in Locust Methods of studying behaviour: Brain lesions; electrical stimulation, drug administration. Effect of toxins, drugs and alcohol on human behaviour and addiction.
UNIT-2 Teaching Hours (6)	Types of behaviour and their regulation: (i)Components of feeding behaviour, hunger drive, directional movement, avoidance, eating,carrying and hoarding (ii)Factors influencing choice of food (iii) Nervous regulation of food and energy intake (a) Motivated behaviour, Drive, satiation and neuro-physiological control (b) Feeding behaviour (c) Learning: Habituation conditioned reflex: trial and error, latent learning, learning and discrimination, imprinting, neural mechanism of learning. (d) Instinctive behaviour; concept, phyletic descent and physiology (e) Hormones and behaviour, Mammalian nervous system with special reference to the involvement of hypothalamus in the regulation of behavioural patterns
UNIT-3 Teaching Hours (6)	Social behaviour in Primates (a) Primate societies (b) Social signals, olfactory, tactile, visual, vocal (c)Status: Dominance and hierarchy territorial behaviour courtship and mating aggression. Behaviour of domestic and zoo animals Behaviour in birds: Behaviour of Streptopelia (ring dove) homing and migration
UNIT-4 Teaching Hours (6)	Reproductive behaviour in fish(Stickle back or any other fish) Social behaviour in insects: Communication; concealment behaviour. The role of pheromones (A general account) Behavioural genetics: Single gene effect, multiple gene effect, behavioural variation in an individual, genetics and human behavior
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing

	7. Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 15.		

End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZP-303**	**Course Type :**	Core Course-13
Course Title :	**PRACTICAL WORK BASED ON PAPER 301 AND 302**		
Credit:	2	**Hours:**	3 Hours/Week
		Total Teaching Hours:	39 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous& Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

PRACTICAL WORK BASED ON PAPER 301 AND 302

1. Chordates '

(a) Taxonomy: Study of museum specimens or representative, animals from all chordate groups (protochordates to mammals).

(b) Anatomy (Models, Charts, Computer simulation):

(i) General anatomy and neural gland of Herdmania.

(ii) Afferent and efferent arteries, cranial nerves of any commercial fish.

(iii) Study of fish anatomy through serial section of fryand fingerling stages.

(iv) Limb musculature, cranial nerves and eye muscles and their innervations in frog,

(v) General anatomy, major blood vessels and cranial nerves of any nonpoisonous snake.

(vi) Study of differences between poisonous and non-poisonous snakes.

(vii) Flight muscles, perching mechanism, air sacs and anatomy of the neck region in the pigeon.

(vii) Reproductive system and anatomy of the neck region in rat.

(viii) General anatomy, digestive, respiratory and urinogenital systems in chick

(c) Osteology: Comparative study of the axial and appendicular skeleton from fish to mammals, with particular reference the important skull types in reptiles' birds and mammals. Alizarins and Victoria-blue preparation of the skeleton of any vertebrate, dried and articulated preparation of the skeleton of any vertebrate.

(d) Permanent Preparations: Spicules and pharyngeal wall of Herdmania, velum and pharyngeal wall of Amphioxus. Whole mounts of pelagic tunicates, ampulla's of Lorenzini in a skate or ray; Different types of scales, ear ossicles of rat or any other mammal.

(e)Histology: A detailed study of the histology of all mammalian tissues and organs through prepared slides to be made available .

2. Ethology:

(a) Study of the process of learning in rat with the help of animal Maize, analysis of the results of simple experiments.

(b) Study of the shock and avoidance behaviour in rat including extinction and relearning; analysis of the result of these experiments

(c) Imprinting in precocial birds

(d) Chemical communication in the earthworm

(e) Study of the food preferences and feeding behaviour of an insect pest.

(f) Study of the phototactic response in Trobolium/Housefly

(g) Study of habituation in chicks.

3. Zoological tourTour is compulsory for all the candidates to observe and study Vertebrate fauna in natural habitat.

(Note - use of animals for dissection/practical work is subject to the conditions that these are not banned under the Wild Life Protection Act and UGC guidelines.)

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Periodical Revision Of Syllabus	3. Annual **4.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-304 (A)**	**Course Type :**	Elective Course-01
Course Title :	**ENVIRONMENTAL BIOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Concepts and Scope Environmental Biology, Earth, man and environment. The earth systems and Biosphere: Conservation of matter in various geospheres-lithosphere hydrosphere, atmosphere and biosphere. Climates of India
UNIT-2 Teaching Hours (13)	Impact of environment at cellular lever: Cellular interaction with environment with special reference to pH, light, temperature and salinity.
UNIT-3 Teaching Hours (13)	Environmental Physiology: Ecophysiological adaptations with special reference to desert, high attitudes lotic, marine environment, Hibernation and aestivations. Poikilo-therms and Homeotherms. Response to temperature and pressure. Thermal properties of water and survival limits. Acclimatization.
UNIT-4 Teaching Hours (13)	A detailed study of different ecosystems: Study will include Abiotic and biotic components and their interrelationships, productivity and adaptations of animals. Terrestrial ecosystems: Grasslands, including grazing lands.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10

	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-305(A)**	**Course Type :**	Elective Course-02
Course Title :	**ENVIRONMENTAL BIOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	A detailed study of different ecosystems: Study will include Abiotic and biotic components and their interrelationships, productivity and adaptations of animals. (I) Forests: Characteristics of alpine, temperate and tropical forests. Stratification.High altitude with special reference to Himalayan Ecology. (II) Deserts: Types and ecological attributes of desert biota.
UNIT-2 Teaching Hours (13)	A detailed study of different ecosystems: Study will include Abiotic and biotic components and their interrelationships, productivity and adaptations of animals. (I) Taiga: Extent and ecological peculiarities. (Il) Tundra: Extent and ecological peculiarities.
UNIT-3 Teaching Hours (13)	Aquatic Ecosystems : (i) Fresh water: Lakes including salt lakes, ponds streams, springs, rivers and marshes. (ii) Marine ecosystem: Zonation, fauna. (iii) Estuarine: Ecological peculiarities, adaptations including impact on fauna.
UNIT-4 Teaching Hours (13)	Major biogeography (zoogeographic and phytogeographic) regions of the world and India, extent, characteristics and species composition. Development and evolution of ecosystems, causes and kinds of succession. Diversity and productivity in relation to stages of succession and development. Urban, rural and other man made ecosystems their impact on flora and fauna, socio-ecological impacts of urbanization and industrialization.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10

&Comprehensive Assessment (CCA)	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III

Course Code:	**MSZP-306 (A)**	**Course Type :**	Elective Course-03
Course Title :	**PRACTICALS FOR ENVIRONMENTAL BIOLOGY 304 A & 305 A**		
Credit:	2	**Hours:**	3 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

1. Water quality analysis (Physico- chemical parameters).
(a) Temperature (b) pH (c) Dissolved oxygen
(d) Acidity (e) Hardness (f) Alkalinity
(g) Chlorides. (h) Sulphates (i) Total dissolved solids
(j) BOD (k) COD
2. Microscopic examination of water: Indicators of pollution, Phytoplanktons and littoral fauna and flora and slide preparation of phytoplankton.
3. Bioassays of polluted waters using fish or other aquatic organisms.
4.Statistical analysis: Grouping of data and preparation of frequency distribution.
Histogram and frequency polygon; Calculating mean, median and mode for grouped and ungrouped data; Calculating standard deviation for grouped and ungrouped data; Fitting simple linear regression. Plotting scatter diagram and regression line; Computing correlation coefficient and testing its significance for grouped and ungrouped data.
5.Spots:- Local flora- Terrestrial and aquatic
Local fauna- Terrestrial and aquatic
6. Sampling procedures and report on a case study. (Students are expected to give complete ecological report of the trip including ecosystem structures; indicators and estimation of environmental degradation, if any)

Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)

S. No.	CCA- Components	Max. Marks Allocation
1.	Monthly test	20*3 Test=60
2.	Quizzes and Assignments	10
3.	Viva-voce	10
4.	Seminar/Symposia	10
5.	Report writing	10
6.	Workshop	10
7.	Review of literature	10
8.	Creativity/Innovation	10
9.	Experimental Skill	10
10.	Co-curricular activity	10
11.	Attendance	10

Total 160 marks equivalent reduced to CCA original marks 30.

Semester End Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-304 (B)**	**Course Type :**	Elective Course-01
Course Title :	**ENTOMOLOGY(B)**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	A general idea of fossil insects, evolution of insects; Insect classification (up to orders and suborders). Detailed classification of important and selected super families and families of the following orders of economic importance: Orthoptera, Isoptera.
UNIT-2 Teaching Hours (13)	Detailed classification of important and selected super families and families of the following orders of economic importance: Homoptera, Hemiptera.
UNIT-3 Teaching Hours (13)	Detailed classification of important and selected super families and families of the following orders of economic importance: Lepidoptera, Diptera.
UNIT-4 Teaching Hours (13)	Detailed classification of important and selected super families and families of the following orders of economic importance: Coleoptera, Hymenoptera.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10

	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-305 (B)**	**Course Type :**	Elective Course-02
Course Title :	**ENTOMOLOGY(B)**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	nsect morphology: Head, thorax, abdomen and their appendages Integument.
UNIT-2 Teaching Hours (13)	Functional organization of Muscular, digestive, circulatory systems. excretory, reproductive systems
UNIT-3 Teaching Hours (13)	Functional organization of Nervous and endocrine systems; sense organs, sound and light producing organs.
UNIT-4 Teaching Hours (13)	Embryology: Structure of a typical insect egg, types of metamorphosis met within insects, development: embryonic and post embryonic, diapause.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10

	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZP-306**B	**Course Type :**	Elective Course-03
Course Title :	ENTOMOLOGY PRACTICAL BASED ON PAPER 304 B &305B		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

1.Dissections of grasshopper, house cricket, bug, butterfly, housefly, honey bee, wasp, beetle to study important features of the digestive, circulatory, respiratory, excretory, nervous, reproductive and neuroendocrine systems.
2. Familiarity with techniques and appliances of applying insecticides, experiments for testing the insecticides.
3. Knowledge of rearing insects and of maintaining the in sectary.
4. Exercise in ecology: Soil pH, water pH, free carbon dioxide; dissolved oxygen, chlorides, total alkalinity and total salinity.
5. A tour to visit important centers of entomo1ogical studies.
(Note : Use of animal for dissection and practical work is subject to the conditions that these are not banned under the Wildlife Protection Act and UGC guidelines.)

Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester			

Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-304(C)**	**Course Type :**	Elective Course-01
Course Title :	**FISH BIOLOGY(C)**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	1. General account and phylogenetic significance of ostracoderms and placoderms. 2. Classification of fishes, with distinguishing characters of the principal subdivisions.
UNIT-2 Teaching Hours (13)	Elementary theory banach algebra, Spectral radius of a bounded linear operator on a complex banach space.
UNIT-3 Teaching Hours (13)	General properties of compact linear operators. Spectral properties of compact linear operators on normed spaces. Behaviors of compact linear operators with respect to solvability of operator equations. Fredholm type theorems. Fredholm alternative theorem. Fredholm alternative for integral equations.
UNIT-4 Teaching Hours (13)	Spectral properties of bounded self-adjoint linear operators on a complex Hilbert space. Positive operators. Monotone Sequences theorem for bounded self-adjoint operators on a complex Hilbert space, Square roots of a positive operator.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10

	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZ-305(C)**	**Course Type :**	Elective Course 02
Course Title :	**FISH BIOLOGY(C)**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	**Endoskeleton** **Musculature** **Weberian apparatus.** **Nervous system and sense organs.**
UNIT-2 Teaching Hours (13)	**Food & alimentary canal, physiology of digestion.** **Blood vascular system and circulation of blood**
UNIT-3 Teaching Hours (13)	**Respiratory organs, physiology of respiration and regulation of breathing, air-breathing organs.** **Structure, function and physiology of the swim bladder**.
UNIT-4 Teaching Hours (13)	**Excretory organs and the physiology of excretion, Osmoregulation.** **Endocrine glands, hormones & reproductive behaviour, gonads, reproduction development and hatching, viviparity**
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10

	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSZP-306(C)**	**Course Type :**	Elective Course-03
Course Title :	**FISH BIOLOGY PRACTICAL BASED ON PAPER 304 C & 305 C**		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

1. Micro-technical procedures: Preparation and study of serial sections of a larval fish and representative tissues and organs of fish.
2. Collection of local fishes and their identification upto the species level; Study of the available museum specimens. Identification of fingerlings of Indian Major Carps.
3. Hydro-biological Studies:
(a) Analysis of water to determine the pH, free carbon dioxide; dissolved oxygen, chlorides, calcium, total alkalinity and total salinity.
(b) Collection: estimation and analysis of plankton.
4. Biochemical and-physiological:
(a) Estimation of Glycogen in liver.
(b) Determination of pool size or free amino acids of muscle or blood plasma through chromatography.
(c) Effect of epinephrine on the chromatophores
(d) Induced spawning
(e) Active transport in tubule.
5. Field studies
(a) Periodical visits to a local fishing farm offish centre to gain a first hand knowledge of its pisciculture practices and fisheries activities.
(b) A week's tour of an inland fisheries research station of Pisciculture centre. The suggested places for the tour are Udaipur;-RanaPratap Sager Dam at Kota, Alwar, Bhartapur, Allahabad,Cuttack and Barrackpore
(c) A week's stay and work at an important marine Biological or fisheries centre in the country.The suggested places for this work are Veraval, Central Institute of Fisheries Education at Bombay and National Institute of Oceanographic Research at Goa.
Note: A record of the work done under Item 7 has to be compulsorily submitted by each candidate.
(Note: Use of animals for dissection/practical work is subject to the conditions that these are not banned under thewild life protection act and UGC guidelines.)

Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning

<table>
<tr><td></td><td colspan="3">10. Workshops/Experiments
* The teaching and learning strategies may be change as per requirement of the students and their capabilities.</td></tr>
<tr><td rowspan="13">Continuous &Comprehensive Assessment (CCA)</td><td>S. No.</td><td>CCA- Components</td><td>Max. Marks Allocation</td></tr>
<tr><td>1.</td><td>Monthly test</td><td>20*3 Test=60</td></tr>
<tr><td>2.</td><td>Quizzes and Assignments</td><td>10</td></tr>
<tr><td>3.</td><td>Viva-voce</td><td>10</td></tr>
<tr><td>4.</td><td>Seminar/Symposia</td><td>10</td></tr>
<tr><td>5.</td><td>Report writing</td><td>10</td></tr>
<tr><td>6.</td><td>Workshop</td><td>10</td></tr>
<tr><td>7.</td><td>Review of literature</td><td>10</td></tr>
<tr><td>8.</td><td>Creativity/Innovation</td><td>10</td></tr>
<tr><td>9.</td><td>Experimental Skill</td><td>10</td></tr>
<tr><td>10.</td><td>Co-curricular activity</td><td>10</td></tr>
<tr><td>11.</td><td>Attendance</td><td>10</td></tr>
<tr><td colspan="3">Total 160 marks equivalent reduced to CCA original marks 30.</td></tr>
<tr><td>End Semester Examination pattern for post graduate Programme</td><td colspan="3">NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.</td></tr>
<tr><td>Periodical Revision Of Syllabus</td><td colspan="3">1. Annual
2. However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.</td></tr>
</table>

(Duration 5 h)

Total 40 MarksSCHEME OF PRACTICAL EXAMINATION AND DISTRIBUTION OF MARKS

General Chordates and Ethology

(a) Chordate's major dissection/demonstration 15 Marks
(b) Permanent preparation 10Marks
(c) Exercise in Ethology 10Marks
(d) Microtomy 05Marks
(e) Identification and comments of spots (5) 10Marks
(f) Viva- voce 10Marks
(g) Class Record 10Marks
Total 70Marks
Internal Assessment 30marks
Grand Total 100 Marks

A. Environmental Biology

(a) Water analysis 15 Marks
(b) Microscopic Examination of water and
slide preparation(Phytoplankton) 10 Marks
(c) Bioassay method/Statistical method 10 Marks
(d Spots (5) 05 Marks
(e) Project report (Case Study) 10 marks
(f) Viva- voce 10 Marks
(g) Class Record 10 marks
Total 70 Marks
Internal Assessment 30 marks
Grand Total 100 Marks

B. Entomology

(a) Permanent preparation 20 Marks
(b) Identification of 3 insects using taxonomic key 12 Marks
(c) Spots (4) 08 Marks
(d) Project/Field Report 10 Marks
(e) Viva- voce 10 Marks
(f) Class Record 10 Marks
Total 70 Marks
Internal Assessment 30 marks
Grand Total 100 Marks

C. Fish Biology

(a) Major Dissection/ demonstration 20 Marks
(b) Minor dissection/demonstration 12 Marks
(c) Permanent preparation 08 Marks
(d) Identification and comments on Spots (5) 10 Marks
(e) Viva-voce 10 Marks
(f) Class Record 10 marks
Total 70 marks
Internal Assessment 30 marks
Grand Total 100 Marks

M.Sc.(Zoology) SEMESTER III			
Course Code:	**MSM-307SC**	**Course Type :**	Skill Course-02
Course Title :	**Teaching Technology and Research Methodology in Zoology and Service Learning**		
Credit:	0	**Hours:**	3 Hours/Week
		Total Teaching Hours:	39 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (SEE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	SEE	Mid. Test	
Duration	3 Hrs	1 Hr	

Objective:
The Objective of this course is to introduce concept of teaching skill, teacher's role and responsibilities, research methodology, Roles and responsibilities ofresearchstudentand guide. Introducing Zoological research methodology, organizing a research paper in various format and software tools.

Course Outcomes: On the completion of the course, the students will be able to

1. Understand the concept of effective teaching skill with influencing facts to serve future students.
2. Know the Teacher's role and responsibilities.
3. Understand the concept of research methodology, scientific methods in Zoological sciences.
4. Know roles and responsibilities ofresearchstudentand guide.
5. Know organizing a research paper and writing skill in different style.
6. Create ability to doing research and teaching profession for future career.

UNIT-1 Teaching Hours (13)	**Teaching Technology** Development of concept of teaching, Teaching skills, Chalk board skills, Teaching practices, Effective teaching, Models of teaching, Teaching aids (Audio-Visual), Teaching aids (projected and non-projected),Communicationskills,Feedbackinteaching,Teacher'sroleandresponsibilities,Information technology for teaching.
UNIT-2 Teaching Hours (13)	**Research Methodology** Introduction to research and research methodology, Scientific methods, Choice of research problem, Literature survey and statement of research problem, Reporting of results, Roles and responsibilities of research student and guide.
UNIT-3 Teaching Hours (13)	**Zoological research methodology** Introducing Zoological Journals, Reading a Journal article, Zoological writing skills. Standard Notations and Symbols, Using Symbols and Words, Organizing a paper, Defining variables, Symbols and notations, Different Citation Styles, IEEE Referencing Style in detail. Package for Zoological Typing, MS Word, Math Type, Open Office Math Editor, Tex, yEd Graph Editor, Tex in detail, Installation and Set up, Text, Formula, Pictures and Graphs, Producing various types of document susingTeX.

UNIT-4 Teaching Hours (13)	**Service Learning** Guidelines for service learning: One among the following can be considered as service learning module: 1. Tie up with schools for teaching elementary Zoology in an easier way. 2. Developinge-contentforparticulartopicswhichwillbeaVehicleforTeachingCurriculumTheory, Assessment, and Design(as per the requirements). 3. **Zoological Exhibition:** To strengthen students' Zoology skills, a **Zoological** camp can be organized in the school premises. Students will participate in challenging academic coursework of Zoology, make projects related to **Zoological** concepts, and explore many inventions and historical aspects inZoology.Studentscanstrengthenandexpandtheirscientificand**Zoological**knowledge whilehavingfun. 4. StudentscancreateawebsitefortheDepartmentofZoology/theprojectarea,puttingall the information about the activities and events coming up. 5. Students can assist in statistical research(based on its needs), in developing a survey tool, organizing and/or conducting the survey, compiling and analyzing data, or some combination of these or some other statistical undertakings. 6. Develop Zoological model and should also be able to provide a solution for an existing real world problem. After deciding, get approval from your respective mentors. 1. Each student will develop a learning/lesson plan composed of three (3-4) measurable learning objectives. Examples of learning objectives are: a. Improve algebraic/problem solving skills. b. Improve methods of communicating Zoology to others effectively. c. Identify common mistakes and misconceptions that Zoology student make. 2. A minimum of fifteen (15) hours documented service is required during the semester. 3. A student must keep a log of the volunteered time. 4. A student must writeadiarycontainingananalysisoftheactivitiesofthedayandtheservicesperformed. **5.** A studentmust writeareflectivejournalcontainingananalysisofthelearningobjectives.
Teaching And Learning Strategies	11. Lecture method 12. Problem Solving method 13. Graphical method 14. Seminar/Symposia 15. Review of literature 16. Report writing **17.** Group Discussion **18.** Videos/Animation **19.** Self-Learning/e-Learning **20.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the**

<table>
<tr><td></td><td colspan="3">students and their capabilities.</td></tr>
<tr><td rowspan="12">Continuous &Comprehensive Assessment (CCA)</td><td>S. No.</td><td>CCA- Components</td><td>Max. Marks Allocation</td></tr>
<tr><td>1.</td><td>Monthly test</td><td>20*3 Test=60</td></tr>
<tr><td>2.</td><td>Quizzes and Assignments</td><td>10</td></tr>
<tr><td>3.</td><td>Viva-voce</td><td>10</td></tr>
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<tr><td>5.</td><td>Report writing</td><td>10</td></tr>
<tr><td>6.</td><td>Workshop</td><td>10</td></tr>
<tr><td>7.</td><td>Review of literature</td><td>10</td></tr>
<tr><td>8.</td><td>Creativity/Innovation</td><td>10</td></tr>
<tr><td>9.</td><td>Experimental Skill</td><td>10</td></tr>
<tr><td>10.</td><td>Co-curricular activity</td><td>10</td></tr>
<tr><td>11.</td><td>Attendance</td><td>10</td></tr>
<tr><td colspan="4">Total 160 marks equivalent reduced to CCA original marks 30.</td></tr>
<tr><td>Semester End Examination pattern for post graduate Programme</td><td colspan="3">NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.</td></tr>
<tr><td>Periodical Revision Of Syllabus</td><td colspan="3">3. Annual
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<tr><td>Selected Readings</td><td colspan="3">1. R.Varma,Moderntrendsinteachingtechnology,Anmol publicationsPvt.Ltd.,NewDelhi2003.
2. UshaRao,Educationalteaching,HimalayaPublishinghouse,NewDelhi2001.
3. J.Mohanthy,Educational teaching,Deep&DeepPublicationsPvt.Ltd.,NewDelhi2001.
4. K.J. Sree andD. B. Rao,Methods ofteachingsciences, Discoverypublishinghouse, 2010.
5. E.B.Wilson,Anintroductiontoscientificresearch,Reprint,CourierCorporation,2012.
6. R.Ahuja,ResearchMethods,RawatPublications,2001.
7. G.L.Jain,ResearchMethdology,MangalDeepPublictions,2003.
8. B.C.NakraandK.K.Chaudhry,Instrumentation,measurement andanalysis,TMHEducation,2003.
9. CathrynBergerKaye,TheCompleteGuidetoServiceLearning:Proven,PracticalWaystoEngageStudentsin CivicResponsibility, Academic Curriculum,&SocialAction,2009.
10. Butin,D,Service-LearninginTheoryandPractice-TheFutureofCommunityEngagement inHigher Education , Palgrave Macmillan US.,2010.</td></tr>
</table>

SEMESTER IV

Semester-IV										
Courses	**Course Code(s)**	**Course Title**	**Teaching Hours**	**Load Allocation**			**Marks Allocation**			**Credits**
				L	**T**	**P**	**ESE**	**CCA**	**Total**	
Core Courses	**MSZ-401**	DEVELOPMENTAL BIOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-402	ANIMAL ECOLOGY	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-403	PRACTICAL WORK BASED ON PAPER 401 AND 402	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Elective Courses	**MSZ-404***	Elective-4	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZ-405*	Elective-5	**52**	**3**	**1**	**0**	**70**	**30**	**100**	**4**
	MSZP-406*	**Elective 6 (Practical based on Elective 4&5)**	**52**	**0**	**1**	**3**	**70**	**30**	**100**	**2**
Total (*Excluded in total)			**312**	**12**	**6**	**6**	**420**	**180**	**600**	**20**
Total Credits for Semester-IV										**20**
Programme Grand Total of Credits										**76**

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-401**	**Course Type :**	Core Course-14
Course Title :	**DEVELOPMENTAL BIOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 **Teaching Hours (13)**	1. Theories of Development. Preformation and Epigenesis 2. Oogenesis (a) Growth of oocyte and Vitellogenesis (b) Organization of egg cytoplasm; role of the egg cortex: (c) Morphogenetic determination in egg cytoplasm. Spermatogenesis 3. Fertilization; significance of fertilization for development and the essence of activation of the egg. A.Early embryonic development: (a) Patterns of cleavage, blastulation& gastrulation in chordates (Tunicates to mammals). (b) Fate maps. (c) Morphogenetic movements. (d) Mechanics and significance of gastrulation. . B. Causal basis of development: Primary embryonic induction: (a) Concepts of potencies; prospective fates; Progressive determination, Totipotency and Nuclear transfer experiment. (b) Induction of the primitive nervous system (Spemann's primary organizer). (c) Nature & regionally specific properties of inductor. (d) Competence. (e) Abnormal (heterogeneous) inductors. (f) Chemistry & mechanism of action inducing substances
UNIT-2 **Teaching Hours (13)**	1. Cell differentiation and differential activity 2. Organogenesis: (a) Morphogenetic processes in epithelia and mesenchyme in organ formation. (b) Morphogenesis- of the brain; neural crest cells and their derivatives. (c) Development of the eye, heart & alimentary canal and its accessory organs. 3. Maternal contribution in early embryonic development 4. Genetic regulation of early embryonic development (Drosophila development as a model).

UNIT-3 Teaching Hours (13)	1. Embryonic adaptations: (a) Evolution of the cleidoic egg and its structural and physiological adaptations. (b) Development & physiology of the extra- embryonic membranes in amniotes. . (c) Evolution of viviparity. (d) Development, types and physiology of the mammalian placenta. 2. Metamorphosis in Amphibia (a) Structural & Physiological changes during metamorphosis. (b) Endocrine control of metamorphosis
UNIT-4 Teaching Hours (13)	1. Regeneration: (a) Types of regeneration, physiological, reparative and compensatory hypertrophy regenerative ability in chordates. . (b) Morphological and histological process in amphibian limb regeneration. (C) Wolffian regeneration (d) Origin of cells of regeneration, de-differentiation, re-differentiation, pattern formation during amphibian limb regeneration, reasons for the absence of limb regenerative ability in mammals. 2. Methods for induction of regenerations.
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		

End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-402**	**Course Type :**	Core Course15
Course Title :	**ANIMAL ECOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	. Concepts of modem ecology. 2. Limiting factors: Liebig's law of minimum, Shelford's law of tolerance; combined concept of limiting factors, conditions of existence as regulatory factors.
UNIT-2 Teaching Hours (13)	3. Analysis of Environment. (a) The general environment. (b) Role of Physical factors: temperature, light water; atmospheric gases, the media, substratum, climatology. (c) Brief review of important physical factors as limiting factor. (d) Nutrients and environment.
UNIT-3 Teaching Hours (13)	1. Organization at the population level: (a) General properties of population. (b) Population growth form and forces shaping the population growth. (c) Measurement of Population. Simple numerical problems on measurement of population to be done. . (d) Animal aggregation and social life. 2. Organization at the community level: (a) Biotic community concept. (b) Community structure and concept of community dominance. (c) Ecotone and concept of "edge effect". (d) Pattern in communities: Stratification, zonation, activity, food web, reproductive and social structure. (e) Community versus the continum. (f) Evolution of Communities; Palaecology; Community structures in past ages.

UNIT-4 Teaching Hours (13)	3. Ecological regulations: (a) Succession in community: Basic types of succession, convergence and divergence in succession; modifications in succession; concept of climax, mono-climax versus poly-climax theory; barriers and ecesis in succession; Biome. (b). Fluctuations within Community; irruptive cycle, fluctuation, causes of fluctuation cycles. 1. Environment and animals: a. Nature and constituents of ecosystem. b. Fundamental, operation of ecosystem c. Flow of matter and energy in ecosystem d. Homeostasis in the ecosystem e. Cycling of chemical elements in ecosystem. f. Concept of productivity: Productivity of land and water, measurement of productivity. 4. Organization and dynamics of ecological communities: The habitat approach: A detailed knowledge of extent, Zonation, environment biota, adaptations and communities of fresh water, marine, terrestrial and estuarine ecosystems. 5. The ecological outlook: Space ecology, nuclear radiation, human population explosion, resources and applied human ecology.
Teaching And Learning Strategies	Lecture method Problem Solving method Graphical method Seminar/Symposia Review of literature Report writing Group Discussion Videos/Animation Self-Learning/e-Learning Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

Continuous &Comprehensive Assessment (CCA)	S. No.	CCA- Components	Max. Marks Allocation
	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		

End Semester

Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.
Periodical Revision Of Syllabus	3. Annual **4.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZP-403**	**Course Type :**	Core Course 16
Course Title :	**PRACTICAL WORK BASED ON PAPER 401 AND 402**		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

1. Development Biology:
(a) Study of development of frog or toad through:
(i) Formalin preserved or living material (egg, spawn, embryo, larvae and metamorphic stages).
(ii) Permanent microscopic slide of sections through representative regions of successive embryonic and larval stages
(b) Study of development of chick through
(i) Permanent whole mounts of successive embryonic stages and
(ii) Permanent microscopic slides of sections through representative regions of successive embryonic stages (Special emphasis should be laid on organogenesis and morphogenesis)
(c) Removal of chick embryos 18, 21, 24, 33, 72 and 92 hours from the egg and their study and identification in the living state.
(d) Study of (i) formalin preserved fetuses with placenta and (ii) histology of placenta of any mammal.
2. Ecology:
(a) Measurement of climatic factors (atmospheric, water, temperature and relative humidity)
(b) Measurement of water, soil pH, edaphic factors of soil, preparation of soil extract,
determination of humidity in mocrohabotat. pH, Alkalinity of water; pH, dissolve oxygen, free carbondioxide, chloride, salinity, temporary and permanent hardness of water, velocity of current.
(c) Measurement of population density, Numerical problems of population determination to be done
(d) A field study of any one of the following habitat to be assigned to an individual or to a group of students.
(e) Mode of life and types of beak and feet in birds.

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-404 (A))**	**Course Type :**	Elective Course 04
Course Title :	**ENVIRONMENTAL BIOLOGY D1**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	1.History of man and his cultural evolution in relation to impact on environment. 2. Management of Environment: Natural resources, their conservation and development: (i) Agriculture and forestry including pest management. (ii) Wild life resources.
UNIT-2 Teaching Hours (13)	1. Mineral resources. 2. Aquaculture (Fresh and Marine)
UNIT-3 Teaching Hours (13)	1. Energy resources 2. River basin
UNIT-4 Teaching Hours (13)	1. Pollution: (Monitoring, sources, effect and control) (a) Water (b)Air (c)Land (d)Thermal (e)Noise (f)Radiation 2. Municipal water supply, sewage and its treatments 3. Environmental health (a) Urban health problem. Impact of urbanization stress, Health status and health problem. (b) Rural health problem (c) Occupational health
Teaching And Learning Strategies	Lecture method Problem Solving method Graphical method Seminar/Symposia Review of literature Report writing Group Discussion Videos/Animation Self-Learning/e-Learning Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10

(CCA)	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	5. Annual **6.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-405(A)**	**Course Type :**	Elective Course 05
Course Title :	**ENVIRONMENTAL BIOLOGY D2**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	1. Environmental legislation in Indian perspective A. Wildlife Protection Act 1972 B. Environmental Protection Act 1986
UNIT-2 Teaching Hours (13)	1. Environmental legislation in Indian perspective A. Biological Diversity Act 2002 B. International Conventions and Treaties
UNIT-3 Teaching Hours (13)	Environmental toxicology: Natural and man made toxicants in the environment and their impact on animal life in different ecosystems; Safety measures; Disposal and management of different types of wastes
UNIT-4 Teaching Hours (13)	Current Environmental Issues: Green House Effect, Ozone layer depletion, Desertification, Soil erosion, Population explosion, Sustainable development 1. Methodology for environmental analysis: (a) Monitoring (b) Analysis or physical and chemical factors. (c) Statistical analysis (d) Bioassay techniques. 2. Environmental Impact Assessment
Teaching And Learning Strategies	Lecture method Problem Solving method Graphical method Seminar/Symposia Review of literature Report writing Group Discussion Videos/Animation Self-Learning/e-Learning Workshops/Experiments * The teaching and learning strategies may be change as per requirement of the students and their capabilities.

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10

	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	7. Annual **8.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings			

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZP-406(A)**	**Course Type :**	Elective Course 06
Course Title :	**PRACTICALS FOR ENVIRONMENTAL BIOLOGY 404 A & 405 A**		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

PRACTICALS FOR ENVIRONMENTAL BIOLOGY 404 A **1 &**404 A**2**

1. Air quality monitoring for:
(a) Settlable matter (b) Suspended particulate matter
2. Soil/ Sediment analysis
(a) EC (b) pH (c) Alkalinity
(d) Organic matter (e) Texture (f) Salinity
3. Microscopie examination of water: Indicators of pollution, Zooplanktons and benthic fauna. Slide Preparation.
4. Statistical analysis: Grouping of data and preparation of frequency distribution.
Histogram and frequency polygon; Calculating mean, median and mode for grouped and ungrouped data; Calculating standard deviation for grouped and ungrouped data; Fitting simple linear regression. Plotting scatter diagram and regression line; Computing correlation coefficient and testing its significance for grouped and ungrouped data.
5.Spots
Instruments/Equipment in environmental studies: viz., pH meter, Turbidimeter, Conductivity meter, Spectrophotometer, Flame photometer, Centrifuge, BOD incubator, COD Flux unit, Air, water and mud samplers, Min.-Max. thermometer, Dry-Wet bulb thermometer, Barometer, Wind wane, Rain gauge, GPS, etc.
6. Field trip to any of the following habitats:
(a) Forest: Wild life sanctuary (b) Fresh water habitat
(c) Marine habitat (d) Semi arid habitat
(Students are expected to give complete ecological report of the trip including ecosystem structures; indicators and estimation of environmental degradation, if any)
Note: Use of animal for dissection and practical work is subject to the conditions that these are not banned under the Wildlife Protection Act and UGC guidelines

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-404(B)**	**Course Type :**	Elective Course 4
Course Title :	**ENTOMOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Definition of pest; Types of pest; General idea of damage caused by pests; Principal methods of pest control: Physical, Mechanical, Cultural, Use of Botanicals, Biological and Legal;
UNIT-2 Teaching Hours (13)	The concept of IPM; A general idea of plant protection organization in India Development of resistance to chemicals. Chemical control: Insecticides: their chief types, modes of action and methods of application/formulation; a general idea of appliances used in the application of insecticides and their safe handling.
UNIT-3 Teaching Hours (13)	Ecology: effect of physical factors. Intra specific and inter-specific relations; dynamics of population
UNIT-4 Teaching Hours (13)	Chemical control: Insecticides: their chief types, modes of action and methods of application/formulation; a general idea of appliances used in the application of insecticides and their safe handling.
Teaching And Learning Strategies	Lecture method Problem Solving method Graphical method Seminar/Symposia Review of literature Report writing Group Discussion Videos/Animation Self-Learning/e-Learning Workshops/Experiments * The teaching and learning strategies may be change as per requirement of the students and their capabilities.

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10

	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-405(B)**	**Course Type :**	Elective Course 5
Course Title :	**ENTOMOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	A general knowledge of chemosterilants, attractants, repellants, pheromones, growth regulators and other compounds Life history, damage caused and control of stored grain pests of cereals and pulses (including general idea of storage)
UNIT-2 Teaching Hours (13)	Life history, damage caused and control of 3 major pests of the main crops: wheat, paddy, maize, jowar, millet, sugarcane, cotton and oil seeds
UNIT-3 Teaching Hours (13)	Social life in Isoptera and Hymenoptera, caste determination in social insects; Life cycle of aphids, Phase theory of locust
UNIT-4 Teaching Hours (13)	Beneficial insects: Silkworm, honey bee and lac insect and industries related to them; Insects as vectors of diseases and their control– mosquitoes, house flies, sand flies, lice, fleas. Insect borne. diseases of man – Typhus, yellow fever, dengue fever, malaria, encephalitis, plague, leishmaniasis.
Teaching And Learning Strategies	Lecture method Problem Solving method Graphical method Seminar/Symposia Review of literature Report writing Group Discussion Videos/Animation Self-Learning/e-Learning Workshops/Experiments * The teaching and learning strategies may be change as per requirement of the students and their capabilities.

Continuous &Comprehensive Assessment (CCA)

S. No.	CCA- Components	Max. Marks Allocation
1.	Monthly test	20*3 Test=60
2.	Quizzes and Assignments	10
3.	Viva-voce	10
4.	Seminar/Symposia	10
5.	Report writing	10
6.	Workshop	10
7.	Review of literature	10
8.	Creativity/Innovation	10

	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	1. Annual **2.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings			

M.Sc.(Zoology) SEMESTER IV			
Course Code:	MSZP-406 (B)	Course Type :	Elective Course 6
Course Title :	ENTOMOLOGY PRACTICAL BASED ON PAPER 404 B & 405 B		
Credit:	2	Hours:	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE		Mid. Test
Duration	3 Hrs		1 Hr

1.Dissections of grasshopper, house cricket, bug, butterfly, housefly, honey bee, wasp, beetle to study important features of the digestive, circulatory, respiratory, excretory, nervous, reproductive and neuroendocrine systems.
2. Familiarity with techniques and appliances of applying insecticides, experiments for testing the insecticides.
3. Knowledge of rearing insects and of maintaining the in sectary.
4. Exercise in ecology: Soil pH, water pH, free carbon dioxide; dissolved oxygen, chlorides, total alkalinity and total salinity.
5. A tour to visit important centers of entomo1ogical studies.
(Note : Use of animal for dissection and practical work is subject to the conditions that these are not banned under the Wildlife Protection Act and UGC guidelines.)

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-404(C)**	**Course Type :**	Elective Course 01
Course Title :	**FISH BIOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	A general survey of world fisheries, survey of principal fisheries of India (Fresh water, estuarine and marine). Plankton in relation to fisheries.
UNIT-2 Teaching Hours (13)	The biology of Indian major carps, catfishes, Hilsa, sardine, mackerel, sharks, prawns and oysters. Pisciculture and its importance, with special reference to India.
UNIT-3 Teaching Hours (13)	A brief outline on the methods of fishing in fresh water of India. Biochemical composition of fish; fish as food. Bi-products of fishing industry, with special reference to India
UNIT-4 Teaching Hours (13)	Population dynamics: Estimation of population number and mortality rates in fresh waters Fecundity: eggs and life history of fish production with special reference to fresh water
Teaching And Learning Strategies	1. Lecture method 2. Problem Solving method 3. Graphical method 4. Seminar/Symposia 5. Review of literature 6. Report writing **7.** Group Discussion **8.** Videos/Animation **9.** Self-Learning/e-Learning **10.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10

	8.	Creativity/Innovation	10
	9.	Experimental Skill	10
	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	9. Annual **10.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings			

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZ-405(C)**	**Course Type :**	Elective Course 05
Course Title :	**FISH BIOLOGY**		
Credit:	4	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

UNIT-1 Teaching Hours (13)	Aquaria and their uses, setting up and maintenance of aquaria Exotic fishes and their role in Indian fresh waters.
UNIT-2 Teaching Hours (13)	Diseases of fishes (symptoms, etiology and treatment) Problems of fresh water pollution in relation to fisheries with special reference to Rajasthan
UNIT-3 Teaching Hours (13)	Adaptations in Fishes: Deep Sea and Hill Streams Courtship and parental care, a general study of fish behavior
UNIT-4 Teaching Hours (13)	Sound producing organs Bioluminescence Electric Organs Poisons and Venoms: Poison Glands in Fishes Migration and its causes
Teaching And Learning Strategies	11. Lecture method 12. Problem Solving method 13. Graphical method 14. Seminar/Symposia 15. Review of literature 16. Report writing **17.** Group Discussion **18.** Videos/Animation **19.** Self-Learning/e-Learning **20.** Workshops/Experiments *** The teaching and learning strategies may be change as per requirement of the students and their capabilities.**

	S. No.	CCA- Components	Max. Marks Allocation
Continuous &Comprehensive Assessment (CCA)	1.	Monthly test	20*3 Test=60
	2.	Quizzes and Assignments	10
	3.	Viva-voce	10
	4.	Seminar/Symposia	10
	5.	Report writing	10
	6.	Workshop	10
	7.	Review of literature	10
	8.	Creativity/Innovation	10
	9.	Experimental Skill	10

	10.	Co-curricular activity	10
	11.	Attendance	10
	Total 160 marks equivalent reduced to CCA original marks 30.		
End Semester Examination pattern for post graduate Programme	NET examination for PG or any other pattern notified by the University at the time of commencement of the respective semester.		
Periodical Revision Of Syllabus	11. Annual **12.** However, the University may revise the syllabus at any time during the running semester after giving a notice for a period one month.		
Selected Readings			

M.Sc.(Zoology) SEMESTER IV			
Course Code:	**MSZP-406 (C)**	**Course Type :**	Elective Course 06
Course Title :	**FISH BIOLOGY PRACTICAL BASED ON PAPER 404 C&405 C**		
Credit:	2	**Hours:**	4 Hours/Week
		Total Teaching Hours:	52 Hours
Max. Marks:	100	**Minimum Pass Marks:**	36
Theory Examination (ESE):	70	**Minimum Pass Marks:**	25
Continuous &Comprehensive Assessment (CCA)	30	**Minimum Pass Marks:**	11
Attendance Eligibility	75 Percent In Respective Semester		
Examination	ESE	Mid. Test	
Duration	3 Hrs	1 Hr	

1. Micro-technical procedures: Preparation and study of serial sections of a larval fish and representative tissues and organs of fish.
2. Collection of local fishes and their identification upto the species level; Study of the available museum specimens. Identification of fingerlings of Indian Major Carps.
3. Hydro-biological Studies:
(a) Analysis of water to determine the pH, free carbon dioxide; dissolved oxygen, chlorides, calcium, total alkalinity and total salinity.
(b) Collection: estimation and analysis of plankton.
4. Biochemical and-physiological:
(a) Estimation of Glycogen in liver.
(b) Determination of pool size or free amino acids of muscle or blood plasma through chromatography.
(c) Effect of epinephrine on the chromatophores
(d) Induced spawning
(e) Active transport in tubule.
5. Field studies
(a) Periodical visits to a local fishing farm offish centre to gain a first hand knowledge of its pisciculture practices and fisheries activities.
(b) A week's tour of an inland fisheries research station of Pisciculture centre. The suggested places for the tour are Udaipur;-Rana Pratap Sager Dam at Kota, Alwar, Bhartapur, Allahabad, Cuttack and Barrack pore
(c) A week's stay and work at an important marine Biological or fisheries centre in the country. The suggested places for this work are Veraval, Central Institute of Fisheries Education at Bombay and National Institute of Oceanographic Research at Goa.
Note: A record of the work done under Item 7 has to be compulsorily submitted by each candidate.
(Note: Use of animals for dissection/practical work is subject to the conditions that these are not banned under the wild life protection act and UGC guidelines.)

SCHEME OF PRACTICAL EXAMINATION AND DISTRIBUTION OF MARKS

(a) Exercise in Ecology 15 Marks

(b) Exercise in developmental biology 10 Marks

(c) Permanent preparation 10 Marks

(d) spots (5) 10 Marks

(e) Tour Report and Seminar 05 Marks

(f) Viva- voce10Marks

(g) Class Record 10 Marks

Total 70 Marks

Internal Assessment 30 marks

Grand Total 100 Marks

Board Second (Special paper)

A. Environmental Biology

(a) Air/Soil analysis 15 Marks

(b Microscopic Examination of water and

slide preparation(Zooplankton/ Benthos) 10 Marks

(c) Statistical method 10 Marks

(d Spotting 10 Marks

(e) Field trip/ Project report 05 marks

(f) Viva- voce 10 Marks

(g) Class Record 10 marks

Total 70 Marks

Internal Assessment 30 marks

Grand Total 100 Marks

(b) Entomology

(a) Dissection 15 Marks

(b) Exercise in Ecology 15 Marks

(c) Permanent preparation / Study of Pests 10 Marks

(d) Project/ Field Report 10 Marks

(e) Viva- voce 10 Marks

(f) Class Record/ Field Report 10 Marks

Total 70 Marks

Internal Assessment 30 marks

Grand Total 100 Marks

(c) Fish Biology

(a) Species identification using taxonomic key (2 fishes) 15 Marks

(b) Hydro-biological Exercise 05 Marks

(c) Biochemical/Physiological exercise/Permanent Preparation 10 Marks

(d) Project/Field report(Hand written, not more than 100 pages) 05 Marks

(e) Identification and comments on Spots (4) 10 Marks

(f) Viva-voce 10 Marks

(g) Class Record 10 marks

Total 70 Marks

Internal Assessment 30 marks

Grand Total 100 Marks