



SCHOOL OF SCIENCES
(FORMERLY, SCHOOL OF ARCHITECTURE, SCIENCE AND TECHNOLOGY)
YASHWANTRAO CHAVAN MAHARASHTRA OPEN UNIVERSITY



Syllabus:

V155: M.Sc. (Zoology){2023 Pattern}

(Semester 01 to 04)

(Incorporating
NEP2020
Recommendations,
PG Credit and
Curriculum
Framework GR
dated 16-05-2023)

With effect from Academic
Year 2023-24, vide G.R.
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2023

Email: director.ast@ycmou.ac.in

Website: www.ycmou.ac.in

Phone: +91-253-2231473

Contents

About the Programme	11
Programme Objective, Programme Outcomes and Scope	11
Mode of Education	12
Mode of Examination	12
Basic Information	12
Eligibility and Fees	14
Programme Structure	15
V155: M.Sc. Zoology {2023 Pattern} as per NEP 2020	15
Semesters and Courses	16
Grading system	17
Evaluation Pattern	19
Successful Completion of Course or Programme	28
SEMESTER 01	29
ZOO501: Biochemistry	29
PROGRAMME INFORMATION	29
COURSE INFORMATION	29
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	29
UNITS	29
DETAILED SYLLABUS	30
LEARNING RESOURCE DETAILS	31
COURSE OUTCOMES	31
ZOO502: Cell Biology	32
PROGRAMME INFORMATION	32
COURSE INFORMATION	32
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	32
UNITS	32
DETAILED SYLLABUS	32
LEARNING RESOURCE DETAILS	34
COURSE OUTCOMES	34
ZOO503: Applied Zoology Part - I	35
PROGRAMME INFORMATION	35
COURSE INFORMATION	35
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	35
UNITS	35

DETAILED SYLLABUS	35
LEARNING RESOURCE DETAILS	36
COURSE OUTCOMES	37
ZOO504: Lab on Biochemistry, Cell Biology & Applied Zoology Part-I	38
PROGRAMME INFORMATION	38
COURSE INFORMATION	38
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	38
DETAILED SYLLABUS	38
LEARNING RESOURCE DETAILS	39
COURSE OUTCOMES	39
RES505: Research Methodology	40
PROGRAMME INFORMATION	40
COURSE INFORMATION	40
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	40
UNITS	40
DETAILED SYLLABUS	41
LEARNING RESOURCE DETAILS	42
COURSE OUTCOMES	43
Elective Courses	44
ZOO506: Developmental Biology	44
PROGRAMME INFORMATION	44
COURSE INFORMATION	44
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	44
UNITS	44
DETAILED SYLLABUS	45
LEARNING RESOURCE DETAILS	45
COURSE OUTCOMES	46
ZOO507: Entomology	47
PROGRAMME INFORMATION	47
COURSE INFORMATION	47
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	47
UNITS	47
DETAILED SYLLABUS	47
LEARNING RESOURCE DETAILS	48
COURSE OUTCOMES	49

SEMESTER 02	50
ZOO509: Molecular Biology	50
PROGRAMME INFORMATION	50
COURSE INFORMATION	50
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	50
UNITS	50
DETAILED SYLLABUS	51
LEARNING RESOURCE DETAILS	52
COURSE OUTCOMES	52
ZOO510: Genetics	53
PROGRAMME INFORMATION	53
COURSE INFORMATION	53
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	53
UNITS	53
DETAILED SYLLABUS	53
LEARNING RESOURCE DETAILS	55
COURSE OUTCOMES	55
ZOO511: Applied Zoology Part-II	56
PROGRAMME INFORMATION	56
COURSE INFORMATION	56
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	56
UNITS	56
DETAILED SYLLABUS	56
LEARNING RESOURCE DETAILS	57
COURSE OUTCOMES	58
ZOO512: Lab on Molecular Biology, Genetics & Applied Zoology Part-II	59
PROGRAMME INFORMATION	59
COURSE INFORMATION	59
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	59
DETAILED SYLLABUS	59
LEARNING RESOURCE DETAILS	60
COURSE OUTCOMES	60
ZOO513: On Job Training (OJT)	61
PROGRAMME INFORMATION	61
COURSE INFORMATION	61

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	61
DETAILS ABOUT ON-JOB-TRAINING (OJT)/INTERNSHIPS	61
GUIDELINES: [IN PROCESS]	61
A. General:	61
B. Monitoring and Evaluation:	62
COURSE OUTCOMES	63
ZOO514: Field Project (FP)	64
PROGRAMME INFORMATION	64
COURSE INFORMATION	64
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	64
DETAILS ABOUT FIELD PROJECT:	64
GUIDELINES: [IN PROCESS]	66
LEARNING RESOURCE DETAILS	67
COURSE OUTCOMES	68
Elective Courses	69
ZOO515: Animal Biotechnology	69
PROGRAMME INFORMATION	69
COURSE INFORMATION	69
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	69
UNITS	69
DETAILED SYLLABUS	70
LEARNING RESOURCE DETAILS	70
COURSE OUTCOMES	71
ZOO516: Toxicology	72
PROGRAMME INFORMATION	72
COURSE INFORMATION	72
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	72
UNITS	72
DETAILED SYLLABUS	72
LEARNING RESOURCE DETAILS	73
COURSE OUTCOMES	74
SEMESTER 03	75
ZOO601: Immunology	75
PROGRAMME INFORMATION	75
COURSE INFORMATION	75

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	75
UNITS	75
DETAILED SYLLABUS	76
LEARNING RESOURCE DETAILS	77
COURSE OUTCOMES	77
ZOO602: Endocrinology	78
PROGRAMME INFORMATION	78
COURSE INFORMATION	78
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	78
UNITS	78
DETAILED SYLLABUS	79
LEARNING RESOURCE DETAILS	79
COURSE OUTCOMES	80
ZOO603: Biodiversity & Conservation	81
PROGRAMME INFORMATION	81
COURSE INFORMATION	81
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	81
UNITS	81
DETAILED SYLLABUS	81
LEARNING RESOURCE DETAILS	82
COURSE OUTCOMES	82
ZOO604: Lab on Immunology, Endocrinology And Biodiversity & Conservation	84
PROGRAMME INFORMATION	84
COURSE INFORMATION	84
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	84
DETAILED SYLLABUS	84
LEARNING RESOURCE DETAILS	85
COURSE OUTCOMES	85
ZOO605: RESEARCH PROJECT - I	86
PROGRAMME INFORMATION	86
COURSE INFORMATION	86
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	86
GUIDELINES:	86
Course Outcomes.....	89

Elective Courses	90
ZOO6o6: Reproductive Physiology	90
PROGRAMME INFORMATION	90
COURSE INFORMATION	90
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	90
UNITS	90
DETAILED SYLLABUS	91
LEARNING RESOURCE DETAILS	91
ZOO6o7: Vermiculture	93
PROGRAMME INFORMATION	93
COURSE INFORMATION	93
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	93
UNITS	93
DETAILED SYLLABUS	93
LEARNING RESOURCE DETAILS	95
COURSE OUTCOMES	95
ZOO6o8: Animal Behaviour	96
PROGRAMME INFORMATION	96
COURSE INFORMATION	96
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	96
UNITS	96
DETAILED SYLLABUS	97
LEARNING RESOURCE DETAILS	97
COURSE OUTCOMES	98
SEMESTER o4	99
ZOO6o9: Animal Physiology	99
PROGRAMME INFORMATION	99
COURSE INFORMATION	99
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	99
UNITS	99
DETAILED SYLLABUS	100
LEARNING RESOURCE DETAILS	101
COURSE OUTCOMES	101
ZOO610: Ichthyology	102
PROGRAMME INFORMATION	102

COURSE INFORMATION	102
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	102
UNITS	102
DETAILED SYLLABUS	102
LEARNING RESOURCE DETAILS	103
COURSE OUTCOMES	104
ZOO611: Lab on Animal Physiology & Ichthyology	105
PROGRAMME INFORMATION	105
COURSE INFORMATION	105
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	105
DETAILED SYLLABUS	105
LEARNING RESOURCE DETAILS	106
COURSE OUTCOMES	106
ZOO612: Research Project – II	107
PROGRAMME INFORMATION	107
COURSE INFORMATION	107
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	107
GUIDELINES:	107
COURSE OUTCOMES	110
Elective Courses	111
ZOO613: Comparative Animal Physiology	111
PROGRAMME INFORMATION	111
COURSE INFORMATION	111
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	111
UNITS	111
DETAILED SYLLABUS	112
LEARNING RESOURCE DETAILS	112
COURSE OUTCOMES	113
ZOO614: Aquaculture	114
PROGRAMME INFORMATION	114
COURSE INFORMATION	114
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	114
UNITS	114
DETAILED SYLLABUS	115
LEARNING RESOURCE DETAILS	116

COURSE OUTCOMES	116
ZOO615: Parasitology.....	117
PROGRAMME INFORMATION	117
COURSE INFORMATION	117
PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES	117
UNITS	117
DETAILED SYLLABUS.....	118
LEARNING RESOURCE DETAILS	118
COURSE OUTCOMES	119
END OF DOCUMENT	119



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Prepared by:


Dr. Chetana Kamlaskar
Director, School of Sciences,
YCMOU, Nashik– 422222

Mr. Rahul Navale
Academic Coordinator, School of Sciences,
YCMOU, Nashik– 422222

PROGRAMME ADVISORY COMMITTEE (PAC)

Yashwantrao Chavan Maharashtra Open University		
Vice-Chancellor: Prof. Sanjeev Sonawane		
School of Sciences		
Director of the School: Dr. Chetana Kamlaskar		
Programme Advisory Committee Members V155: M.Sc. (Zoology) {2023 Pattern}		
Dr. Chetana Kamlaskar Director, Associate Prof., School of Sciences, YCMOU, Nashik	Dr. Sunanda More Former Director, School of Sciences, YCMOU, Nashik	Dr. Sunil Madhukar Gaikwad Associate Professor Department of Zoology, Shivaji University, Kolhapur
Dr. Hemlata Pradeep Nandurkar Head and Associate Professor Department of Zoology, Sant Gadage Baba Amravati University, Amravati	Dr. Anil Kurhe Associate Professor Department of Zoology, PVP College, Pravaranagar, Loni Tal. Rahata, Dist. Ahmednagar	Dr. Ganesh Suryawanshi, Assistant Professor. Yogeshwari Mahavidyalaya, Ambajogai, Dist. Beed
Dr. Kakulte Vikram Raghunath Head and Asst. Professor Department of Zoology, K.R.T. Arts, B.H. Commerce and A.M. Science (KTHM) College, Nashik	Mr. Rahul Navale (Invitee) Academic Coordinator, School of Sciences, YCMOU, Nashik	

NEP2020: Programme Structure with Syllabus of all Courses at Semester 01 to 04 was finalized in PAC meeting held on 24 July 2023.

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Finalized on 31 Aug 2023, 25 Nov 2023 for Evaluation Pattern

SYLLABUS FOR M.Sc. (ZOOLOGY) {2023 PATTERN}

About the Programme

PROGRAMME CODE: V155

PROGRAMME NAME: M. Sc. (ZOOLOGY)

This M.Sc. programme is uniquely designed to impart essential knowledge in all major areas of Zoology. This PG program aims to develop understanding about significance of fauna and their biology from animals of single cell to multi-cellular systems. This programme prepares the students to appreciate the diversity of Earth's fauna, with opportunities to specialize in areas such as animal evolution, behavior and ecology. The course contents of total 04 semesters are a carefully selected blend of theory and practical which prepares students for specialist professional employment, research in academia, and various industries for broader applications. Learner centric curriculum is designed in adherence to the principles of National Education Policy (NEP 2020) to acquire knowledge and skills with valuable experiences through hands-on activities, projects and internships.

Programme Objective, Programme Outcomes and Scope

This programme is designed to achieve following objectives, outcomes and scope.

Objectives:

1. Objectives of the 'M.Sc. (Zoology)' programme are to:

- Inculcate critical thinking and analytical skills to enable students to pursue higher studies and research in Life Sciences or related allied fields of Zoology.
- Provide a strong foundation for a better understanding of current advances in Zoology and its practical significance.
- Expose students to current trends in research about Zoology.

Outcomes: After successful completion of this programme, students will be able to –

- Develop deeper understanding of key concepts of Zoology at biochemical, molecular, cellular, physiological, histological and systematic level.
- Impart knowledge and skills through applied disciplines.
- Integrate and explore biological data. Use current laboratory setup, instrumentation, statistical and biological techniques in the collection, organization, analysis, interpretation and manipulating the data related to Zoology discipline and allied branches.

Scope of the programme: After successful completion of this programme, students may get opportunities in various fields/sectors to work as –

- Career opportunities in both private and government sector/ in India and abroad.

- Job opportunities in sectors like Marine industries, NMCs, Pest Control, zoological parks. Applied business like fisheries, apiculture, sericulture, pearl culture, etc.
- Inculcation of research attitude.
- Inculcation of entrepreneurship.
- Perceive higher education and research in the same or allied fields like veterinary science.

Mode of Education

This Programme will be offered in Open and Distance Learning (ODL) Mode as defined in “UGC Open and Distance Learning Programmes and Online Programmes Regulations, 2020” published in the gazette notification by dated 4th Sept 2020 by the UGC as specified below.

“Open and Distance Learning Mode means a mode of providing flexible learning opportunities by overcoming separation of teacher and learner using a variety of media, including print, electronic, online and occasional interactive face-to-face meetings with the learners or Learner Support Services to deliver teaching-learning experiences, including practical or work experiences”

Mode of Examination

Continuous Assessment is conducted at recognized learner support centres/ study centres and End Examination for all type of courses is conducted at recognized Exam Centres of the University under supervision.

Basic Information

1. **Mode of Education:** ODL Mode
2. **Minimum Programme Duration:** 2 years/ 4 semesters after Candidates with B.Sc. with Zoology at FY and SY/ B.Sc. (Agri) or Equivalent pass.
3. **Maximum Programme Duration:** 4 years from the date of admission to the PG programme, also referred as Valid Registration Period
4. **Learner Support Centers (LSC):** University approved/recognized Senior Science Colleges/ Institutes offering PG Zoology programme.
5. **Medium of Instruction:** English.
6. **Attendance:** Minimum 80% attendance for all type of courses.
7. **Profile of Prospective Students:** In-Service Science Teachers from Schools/ Junior College and Equivalent pass students.
8. **Teaching-Learning:** Total 12 + 3 = 15 working weeks in each semester, where 3-weeks’ time duration in each semester for clearing face-to-face counseling session’s backlog (if any).
9. **Total Teaching-Learning Support:** Total 2640 Hours including Self-Study during all 4 semesters. 660 Hours (including Self-Study) during each semester.
10. **Total Courses:** Total 23 courses (subjects) distributed over Semesters 01 to 04.
11. **Total Credits:** 88 Credits [As per UGC norms 1 Credit means 30 hours of study efforts required to gain learning of particular content of each credit].

12. Total Courses and Credit Distribution Scheme:

Sem	Mandatory Courses (DSC)			Elective Courses (DSE) (4 Credits)	Other Courses (4 Credits)/ (6 Credits)	Total Courses (Credits)
	Theory		Practical (4 Credits)			
	4 Credits	2 Credits				
1	2	1	1	1	1 – Research Methodology (4 Credits)	6 (22 Credits)
2	2	1	1	1	Any one - OJT/ Field Projects (4 Credits)	6 (22 Credits)
3	2	1	1	1	1- Research Project (4 Credits)	6 (22 Credits)
4	2	-	1	1	1- Research Project (6 Credits)	5 (22 Credits)
Total	8 x 4 = 32	3 x 2 = 06	4 x 4 = (16 Credits)	4 x 4 = (16 Credits)	3 x 4 + 1 x 6 = (18 Credits)	23 (88 Credits)
	(38 Credits)					

13. **Multiple Entry and Multiple Exit:** The multiple entry and multiple exit features open up new opportunities for learners, even if they have stopped or discontinued their study in the middle for a variety of reasons. This feature provides entry options in order to promote flexible learning within the valid registration period (04 years from the date of admission to the PG programme). Learners only have the choice to leave the program at the end of even semester 02, and they have the option to reenter at the start of odd semester 03. Only one exit option and reentry is permissible for MSC programme during stipulated time period.

14. **Exit Option- PG Diploma Certificate:** The learner who passes all registered courses of first year (two semesters) of the programme successfully in the examinations and obtains required credits (44 Credits), shall be awarded with **Post Graduate Diploma PGD 13-ZOO** if learner shall opt for exit. The aggregate performance (SGPA of Semester 01 and Semester 02) and Class in the programme shall be reported on the basis of performance.

15. **PG Degree Certificate:** After successful completion of all courses (semesters 01 to 04) at two year of the programme and obtaining required credits (88 Credits), learner shall be awarded with **Post Graduate Degree**. The aggregate performance (CGPA of Semester 01 to Semester 04) and Class in the programme shall be reported on the basis of performance.

16. **Approval/Equivalence Status:** UGC and DEB recognized and approved [AY 2023 and onwards] with UGC/DEB letter F.No. 1-2/2021 (DEB-I), Dated: 02.08.2021, available at https://www.ugc.ac.in/pdfnews/4204139_HEI-Recognition-list-02-08-2021.pdf

Eligibility and Fees

Admission Eligibility	Certification Eligibility	Fees per Year Annual Admission Form Amount (AAFA) is payable to university along with admission form at the start of each year.			
Candidates with B.Sc. degree in Medical Science, Allied Science, Bioscience, or any Life Science specialization.	<p>V155: Min 40% or better marks in total 23 courses (subjects) of total 88 credits at Semesters 01 to 04.</p> <p>CGPA: Aggregate performance and Class in the programme shall be reported on the basis of semesters 01 to 04.</p> <p>For exit option PGD 13-ZOO: Min 40% or better marks in total 12 courses (subjects) of total 44 credits at Semesters 01 to 02.</p>	Description		INR ₹	
				1 st Year	2 nd Year
		Mandatory Fees		608	858
		Tuition Fee	USF	8,000	6,100
			LSCF	12,000	12,000
		End Exam Fees		24,80	23,70
AAFA		23,088	23,228		

Programme Structure

V155: M.Sc. Zoology {2023 Pattern} as per NEP 2020

Year (2 Yr. PG)	Level / Sem.	Major				RM	OJT/ FP	RP	Cum. Cr.
		Mandatory (DSC)	CR	Elective (DSE)	CR				
I	6.0/ Sem I	ZOO501: Biochemistry (T)	4	ZOO506: Development Biology (T) OR ZOO507: Entomology (T)	4	RES505: Research Methodology (T) (4 Cr)	-	-	22
		ZOO502: Cell Biology (T)	4						
		ZOO503: Applied Zoology Part -I (T)	2						
		ZOO504: Lab on Biochemistry, Cell Biology & Applied Zoology Part-I (P)	4						
	6.0/ Sem II	ZOO509: Molecular Biology (T)	4	ZOO515: Animal Biotechnology (T) OR ZOO516: Toxicology (T)	4	-	ZOO513: OJT (4 Cr) OR ZOO514: FP (4 Cr)	-	22
		ZOO510: Genetics (T)	4						
		ZOO511: Applied Zoology Part-II (T)	2						
		ZOO512: Lab on Molecular Biology, Genetics & Applied Zoology Part-II (P)	4						
Cum. Cr. For 1 Years PG Diploma		28		8		4	4	-	44
Exit option: PG Diploma (44 Credits) after Three Year UG Degree PGD 13-ZOO: Post Graduate Diploma in Zoology									
II	6.5/ Sem III	ZOO601: Immunology (T)	4	ZOO606: Reproductive physiology (T) OR ZOO607: Vermiculture (T) OR ZOO608: Animal Behavior (T)	4	-	-	ZOO605: Research Project (4 Cr)	22
		ZOO602: Endocrinology (T)	4						
		ZOO603: Biodiversity & Conservation (T)	2						
		ZOO604: Lab on Immunology & Endocrinology and Biodiversity & Conservation (P)	4						
	6.5/ Sem IV	ZOO609: Animal physiology (T)	4	ZOO613: Comparative Animal Physiology (T) OR ZOO614: Aquaculture (T) OR ZOO615: Parasitology (T)	4	-	ZOO612: Research Project (6 Cr)	22	
		ZOO610: Ichthyology (T)	4						
		ZOO611: Lab on Animal Physiology & Ichthyology (P)	4						
Cum. Cr. For 2 Years PG Degree		54		16		4	4	10	88
2 Years-4 Sem. PG Degree (88 credits) after Three Year UG Degree									

Abbreviations: Yr.: Year; Sem.: Semester; Cumulative Credits: Cum. Cr. ; T- Theory Course; P- Practical course; TW-Term Work; PW- Project Work

Semesters and Courses

Abbreviations of the courses

Mandatory DSC	Discipline Specific Core Course	Elective DSE	Discipline Specific Elective Course
RM	Research Methodology	OJT	On Job Training: Internship/ Apprenticeship
FP	Field projects	RP	Research Project
OE	Open Elective (May be taken from MOOC or may be chosen from other domain of learning to get exposure to interdisciplinary domain) [OE will be offered in phase manner]		

SN	Course Category	Code	Course Name	CA	EE	TM	Type	CR	Min %
[Level 6.0] Semester 01: 22 Credits									
01	Mandatory(DSC)	ZOO501	Biochemistry	30	70	100	T	4	40%
02	Mandatory(DSC)	ZOO502	Cell Biology	30	70	100	T	4	40%
03	Mandatory(DSC)	ZOO503	Applied Zoology Part-I	15	35	50	T	2	40%
04	Mandatory(DSC)	ZOO504	Lab on Biochemistry, Cell Biology & Applied Zoology Part-I	50	50	100	P	4	40%
05	RM	RES505	Research Methodology	30	70	100	T	4	40%
Elective (DSE) Courses (Select Any One)									
06	Elective (DSE)	ZOO506	Developmental Biology	30	70	100	T	4	40%
07	Elective (DSE)	ZOO507	Entomology	30	70	100	T	4	40%
[Level 6.0] Semester 02 : 22 Credits									
09	Mandatory(DSC)	ZOO509	Molecular Biology	30	70	100	T	4	40%
10	Mandatory(DSC)	ZOO510	Genetics	30	70	100	T	4	40%
11	Mandatory(DSC)	ZOO511	Applied Zoology Part-II	15	35	50	T	2	40%
12	Mandatory(DSC)	ZOO512	Lab on Molecular Biology, Genetics & Applied Zoology Part-II	50	50	100	P	4	40%
13	OJT/FP	ZOO513 ZOO514	Any one OJT or FP OJT FP	30	70	100	TW	4	40%
Elective (DSE) Courses (Select Any One)									
14	Elective (DSE)	ZOO515	Animal Biotechnology	30	70	100	T	4	40%
15	Elective (DSE)	ZOO516	Toxicology	30	70	100	T	4	40%
Exit option: PG Diploma {PGD 13 -ZOO (44 Credits)} after Three Year UG Degree									
[Level 6.5] Semester 03 : 22 Credits									
17	Mandatory(DSC)	ZOO601	Immunology	30	70	100	T	4	40%
18	Mandatory(DSC)	ZOO602	Endocrinology	30	70	100	T	4	40%
19	Mandatory(DSC)	ZOO603	Biodiversity & Conservation	15	35	50	T	2	40%
20	Mandatory(DSC)	ZOO604	Lab on Immunology,	50	50	100	P	4	40%

			Endocrinology and Biodiversity & Conservation						
21	RP	ZOO605	Research Project	50	50	100	PW	4	40%
Elective (DSE) Courses (Select Any One)									
22	Elective (DSE)	ZOO606	Reproductive Physiology	30	70	100	T	4	40%
23	Elective (DSE)	ZOO607	Vermiculture	30	70	100	T	4	40%
24	Elective (DSE)	ZOO608	Animal Behavior	30	70	100	T	4	40%
[Level 6.5] Semester 04 : 22 Credits									
25	Mandatory(DSC)	ZOO609	Animal Physiology	30	70	100	T	4	40%
26	Mandatory(DSC)	ZOO610	Ichthyology	30	70	100	T	4	40%
27	Mandatory(DSC)	ZOO611	Lab on Animal physiology & Ichthyology	30	70	100	p	4	40%
28	RP	ZOO612	Research Project	75	75	150	PW	6	40%
Elective (DSE) Courses (Select Any One)									
29	Elective (DSE)	ZOO613	Comparative Animal Physiology	30	70	100	T	4	40%
30	Elective (DSE)	ZOO614	Aquaculture	30	70	100	T	4	40%
31	Elective (DSE)	ZOO615	Parasitology	30	70	100	T	4	40%

Grading system

1. **“Absolute Grading”**: the marks are converted to grades based on pre-determined class intervals.
2. **“Letter Grade”**: It is an index of the performance of students in a said programme. Grades are denoted by letters O, A+, A, B+, B, C, P and F.
3. **“Grade Point”**: It is a numerical weight allotted to each letter grade on a 10-point scale. Grade Point shall be “0 (Zero)” for Letter Grade “Ab” and “F”. The marks scored by the examinee shall be converted into grade points by dividing the marks scored in the aggregate and dividing the resulting number by maximum marks, multiplying the result by ten, retaining the integer part (ignore the fractional part). Thus, if a person has secured 56 marks out of 100 marks in aggregate for a course, we get $(56/100) \times 10$ which is 5.6. Ignoring the fraction, we get 5 as the grade point.

Marks Obtained out of 100	Grade Point	Semester GPA /Programme CGPA Semester/ Programme	% of Marks	Alpha-Sign /Letter Grade Result
90 – 100	10	9.00 – 10.00	90.0 - 100	O (Outstanding)
80 – 89.99	9	8.00 - < 9.00	80.0 - < 90.0	A+ (Excellent)
70 – 79.99	8	7.00 - < 8.00	70.0 - < 80.0	A (Very Good)
60 – 69.99	7	6.00 - < 7.00	60.0 - < 70.0	B+ (Good)
55 – 59.99	6	5.50 - < 6.00	55.0 - < 60.0	B (Above Average)
50 – 54.99	5	5.00 - < 5.50	50.0 - < 55.0	C (Average)
40 – 49.99	4	4.00 - < 5.00	40.0 - < 50.0	P (Pass)
0 – 39.99	0	Below 4.00	Below 40	F (Fail)
		Ab (Absent)	-	Absent

4. **“Credit Point”**: It is the product of grade point and number of credits for a course.
5. **“Semester Grade Point Average (SGPA)”**: It is a measure of performance of work done in a semester. It is the ratio of sum of the product of the number of credits with the grade points scored by a student in all courses taken by a student and the sum of number of credits of all the courses undergone by a student:

$$SGPA (S_i) = \frac{\sum C_i G_i}{\sum C_i}$$

It shall be expressed up to two decimal places.

6. **“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. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme.

$$CGPA = \frac{\sum C_i S_i}{\sum C_i}$$

Where, S_i is the SGPA of the i^{th} semester & C_i is the total number of credits in that semester. It shall be expressed up to two decimal places.

7. **“Transcript or Grade Card or Certificate”**: Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA **earned till that semester**.
8. **“Evaluation Pattern”**: As per NEP2020, the ‘Evaluation Pattern’ of the Post graduate Programme consists of the following components:

Course Type	Number of Credits	Continuous Assessment (CA)	End Examination (EE)	Total Marks ‘TM’ = (EE+CA)	Minimum Passing %
Theory(T)	4	30	70	100	minimum 40% in CA, EE and (CA + EE) shall be essential for each course to pass
Theory (T)	2	15	35	50	
Practical (P)	4	50	50	100	
OJT/Field Project (FP)	4	50	50	100	
Research Project (RP)	4	50	50	100	
Research Project(RP)	6	75	75	150	

Evaluation Pattern

[CA and EE Evaluation Pattern as per the Minutes of the Meeting of the NEP Cell Dated 21.11.2023]

SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)
1	Theory (T) 4 Credit 100 Marks CA: 30% EE: 70%	<p>Each student is required to attempt total 02 (Two) “Continuous Assessments (CAs)” for each course of each Semester, as per the following details:</p> <ol style="list-style-type: none"> CA01: ‘Continuous Assessment 01 (CA01)’ on Credit 01 to Credit 04 of each course, consists of <ul style="list-style-type: none"> 2 (Two) ‘Short Answer Questions (SAQs)’, each carrying 05 Marks, on Credit 01 and Credit 02 and 1 (One) ‘Long Answer Question (LAQ)’ of 10 Marks, on Credit 03 and Credit 04. LAQ may consist of sub-questions. <p>CA01: On Credit 01 to Credit 04, of Marks = $(5 \times 2 + 10) = \mathbf{20 \text{ Marks}}$</p> CA02: ‘Continuous Assessment 02 (CA02)’ on Credit 01 to Credit 04 of each course, consists of <ul style="list-style-type: none"> A test containing total 10 (Ten) ‘Objective Type Questions,’ 05 (Five) on Credit 01 and Credit 02, and 05 (Five) on Credit 03 and Credit 04. Each ‘Objective Type Question’ of 1 Mark. <p>CA02: On Credit 01 to Credit 04, of Marks = 10 Marks</p> Maximum number of attempts for CA, during each semester : Single attempt only Total Marks: 30 Marks 	<ol style="list-style-type: none"> Student is required to answer 05 ‘VSAQs’ out of 06 ‘VSAQs’, each carrying 03 Marks, on Credit 01 to 04, for total 15 Marks. One VSAQ will be on each Credit. Student is required to answer 05 ‘SAQs’ out of 06 ‘SAQs’, each carrying 05 Marks, on Credit 01 to 04, for total 25 Marks. One SAQ will be on each Credit. Student is required to answer 01 ‘LAQ’ out of 2 LAQs, of 10 Marks on Credit 01 and Credit 02, for total 10 Marks. LAQ may consist of sub-questions. Student is required to answer 01 ‘LAQ’ out of 2 LAQs, of 10 Marks on Credit 03 and Credit 04, for total 10 Marks. LAQ may consist of sub-questions. Student is required to answer 01 ‘LAQ’ out of 2 LAQs, of 10 Marks on Credit 01 to Credit 04, for total 10 Marks. LAQ may consist of sub-questions. Number of attempts: Till Valid Registration Period (VRP) only Marks: 70 Marks Duration: 150 minutes

SN	Type of Course	Continuous Assessment (CA)		End Examination (EE)	
		SN	Description	Evaluation of End Examination(EE)	Marks
		1	Question Types	Very Short Answer Question (VSAQ) on each Credit	03 Marks
				Short Answer Question (SAQ) on each Credit	05 Marks
				On each Credit, either Single Long Answer Question (LAQ) or LAQ contains sub-questions (a), (b) and so on.	10 Marks
		2	Grand Total Marks	Total five Questions in EE Question paper based on: Credit 01 to 04 : 05 VSAQs out of 06 VSAQs (15 Marks) Credit 01 to 04 : 05 SAQs out of 06 SAQs (25 Marks) Credit 01 to 02 : 01 LAQ out of 02 LAQs (10 Marks) Credit 03 to 04 : 01 LAQ out of 02 LAQs (10 Marks) Credit 01 to 04 : 01 LAQ out of 02 LAQs (10 Marks) LAQ may contain sub-questions	70 Marks
2	Theory (T) 2 Credit 50 Marks CA: 30% EE: 70%	<p>Each student is required to attempt total 01 (One) “Continuous Assessment (CA)” for each course of each Semester, as per the following details:</p> <ol style="list-style-type: none"> CA01: 1 (One) ‘Continuous Assessment 01 (CA01)’ on Credit 01 and Credit 02 of each course, consists of <ul style="list-style-type: none"> 1 (One) ‘Short Answer Question (SAQ)’ of 5 Marks and 1 (One) ‘Long Answer Question (LAQ)’ of 10 Marks, LAQ may consist of sub-questions. CA01: On Credit 01 and Credit 02, of Marks = (5 + 10) = 15 Marks Maximum number of attempts for CA, during each semester: Single attempt only Total Marks: 15 Marks 		<ol style="list-style-type: none"> Student is required to answer 05 ‘VSAQs’ out of 06 ‘VSAQs’, each carrying 03 Marks, on Credit 01 to 02, for total 15 Marks. One VSAQ will be on each Credit. Student is required to answer 02 ‘SAQs’ out of 03 ‘SAQs’, each carrying 05 Marks, on Credit 01 to 02, for total 10 Marks. One SAQ will be on each Credit. Student is required to answer 01 ‘LAQ’ out of 2 LAQs, of 10 Marks on Credit 01 and Credit 02, for total 10 Marks. LAQ may consist of sub-questions. Number of attempts: Till Valid Registration Period (VRP) only Marks: 35 Marks Duration: 75 minutes 	

SN	Type of Course	Continuous Assessment (CA)		End Examination (EE)	
		SN	Description	Evaluation of End Examination (EE)	
		1	Question Types	Very Short Answer Question (VSAQ) on each Credit	03 Marks
				Short Answer Question (SAQ) on each Credit	05 Marks
				On each Credit, either Single Long Answer Question (LAQ) or LAQ contains sub-questions (a), (b) and so on.	10 Marks
		2	Grand Total Marks	Total three Questions in EE Question paper based on: Credit 01 to 02 : 05 VSAQs out of 06 VSAQs (15 Marks) Credit 01 to 02 : 02 SAQs out of 03 SAQs (10 Marks) Credit 01 to 02 : 01 LAQ out of 02 LAQs (10 Marks) LAQ may contains sub-questions	35 Marks

SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)												
3	Practical (P) 4 Credit 100 Marks CA: 50% EE: 50%	<ol style="list-style-type: none"> Student is required to submit "Activity Report in Work-Book Format" for each Credit in the prescribed format. Maximum number of attempts for each CA, during each semester : Single attempt only Marks: 50 Marks Grading criteria: <table border="1"> <tr> <td>Lab Punctuality, Preparedness & Ethics</td> <td>Irregular in lab. Copies the experiment from others (0 Points)</td> <td>Consistently regular but unable to explain the concepts (06 Points)</td> <td>Punctuality in lab. Follows the procedure and responds to questions asked (10 Points)</td> </tr> <tr> <td>Activity Report and Performance (Experiment No, Date, Objectives, Apparatus with specification, Observations, Graphs, software used if any)</td> <td>Poor Documentation and copied the experiment from others. Couldn't perform the Activity /poor observation made (04 Points)</td> <td>Average Documentation: Report is in format but some of the formatting guidelines are missed. Performed the Activity but observations made with some mistakes (12 Points)</td> <td>Good Documentation: Lab activity writing is in proper format with all references, Grammar. Performed the Activity on time observations made with no mistakes (20 Points)</td> </tr> <tr> <td>Results and Conclusion</td> <td>Unable to achieve the desired results but makes attempts to relate data to theory. Poor concluding statements (08 Points)</td> <td>Average graphical and tabulated representation with misinterpret physical significance of theory. Achieve the desired results and but insufficient conclusion statement. (14 Points)</td> <td>Analyses and interpret observed data carefully with good graphical and tabulated representation using appropriate theory/evidence. Achieve the results and reach to appropriate Conclusion (20 Points)</td> </tr> </table> 	Lab Punctuality, Preparedness & Ethics	Irregular in lab. Copies the experiment from others (0 Points)	Consistently regular but unable to explain the concepts (06 Points)	Punctuality in lab. Follows the procedure and responds to questions asked (10 Points)	Activity Report and Performance (Experiment No, Date, Objectives, Apparatus with specification, Observations, Graphs, software used if any)	Poor Documentation and copied the experiment from others. Couldn't perform the Activity /poor observation made (04 Points)	Average Documentation: Report is in format but some of the formatting guidelines are missed. Performed the Activity but observations made with some mistakes (12 Points)	Good Documentation: Lab activity writing is in proper format with all references, Grammar. Performed the Activity on time observations made with no mistakes (20 Points)	Results and Conclusion	Unable to achieve the desired results but makes attempts to relate data to theory. Poor concluding statements (08 Points)	Average graphical and tabulated representation with misinterpret physical significance of theory. Achieve the desired results and but insufficient conclusion statement. (14 Points)	Analyses and interpret observed data carefully with good graphical and tabulated representation using appropriate theory/evidence. Achieve the results and reach to appropriate Conclusion (20 Points)	<p>External and internal examiners shall assess each student based on:</p> <ol style="list-style-type: none"> Workbook/Activity Report submission by the student (Only by External Examiner) [05 Marks] Practical Activity performed by the student [12 Marks] Result and Conclusion of the Practical Activity [13 Marks] Viva-Voce on Practical Activities [20 Marks] Number of attempts: Till Valid Registration Period (VRP) only Marks: 50 Marks Duration: 180 minutes
Lab Punctuality, Preparedness & Ethics	Irregular in lab. Copies the experiment from others (0 Points)	Consistently regular but unable to explain the concepts (06 Points)	Punctuality in lab. Follows the procedure and responds to questions asked (10 Points)												
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SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)		
			Evaluation of Practical End Examination		
		SN	Description	Internal Examiner	External Examiner
		1	Workbook/Activity Report	-	05 Marks
		2	Actual Conduct of one randomly selected Practical Activity	02 Marks	10 Marks
		3	Diagram, Synoptic Answers, Graph/Observation and Conclusion	03 Marks	10 Marks
		4	Viva-Voce/Oral	05 Marks	15 Marks
		5	Total	10 Marks	40 Marks

SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)																					
4	Field Project (TW) 4 Credit 100 Marks CA: 50% EE: 50%	<p>Students need to complete one month Field Project (Total Study hours 120 hrs including Activity Report). After completion of the field project, learners shall submit a report to the LSC - Programme Coordinator (PC) and Mentor/Guide.</p> <ol style="list-style-type: none"> Maximum number of attempts for each CA, during each semester: Single attempt only Duration: 1 Month or 4 Weeks duration <ol style="list-style-type: none"> After end examination of semester 02 and before beginning of semester 03 or Any one month during semester 02 duration Marks: 50 Marks Grading Criteria for Evaluation of FP (only by Mentor/Guide): <table border="1"> <thead> <tr> <th>SN</th> <th>Description</th> <th>Marks</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Key Definitions of Problem area and analysis of preliminary data</td> <td>15</td> </tr> <tr> <td>2</td> <td>Work related to formats, Correspondence, Interactions and liaising etc</td> <td>05</td> </tr> <tr> <td>3</td> <td>Field work and data collection</td> <td>15</td> </tr> <tr> <td>4</td> <td>Analysis and Report</td> <td>10</td> </tr> <tr> <td>5</td> <td>Feedback to community</td> <td>05</td> </tr> <tr> <td colspan="2" style="text-align: center;">Total</td> <td>50</td> </tr> </tbody> </table>	SN	Description	Marks	1	Key Definitions of Problem area and analysis of preliminary data	15	2	Work related to formats, Correspondence, Interactions and liaising etc	05	3	Field work and data collection	15	4	Analysis and Report	10	5	Feedback to community	05	Total		50	<ol style="list-style-type: none"> External and Internal examiners (Internal examiner - Programme Coordinator (PC) / Supervisor of LSC) shall assess each student based on: <ol style="list-style-type: none"> Activity Report submission by the student (Only by External Examiner) [10 Marks] Viva-Voce on Activity Report [40 Marks] Number of attempts: Till Valid Registration Period (VRP) only Marks: 50 Marks Duration: 180 minutes
SN	Description	Marks																						
1	Key Definitions of Problem area and analysis of preliminary data	15																						
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Total		50																						
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SN	Description	Internal Examiner (Programme Coordinator (PC)/ Supervisor of LSC)	External Examiner																					
1	Workbook/Report submission	-	10 Marks																					
2	Viva-Voce /Oral	10 Marks	30 Marks																					
3	Total	10 Marks	40 Marks																					

SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)																																							
5	OJT or Internship (TW) 4 Credit 100 Marks CA: 50% EE: 50%	<p>1. Students need to complete one month On Job Training (OJT) or Internship (Total Study hours 120 hrs including Internship Report) in any Industry/Organization/Institute/ R&D Division /Any Micro/Small/Medium/enterprise/Govt/ NGO/PSU/Online Internship related to major course.</p> <p>2. Maximum number of attempts for each CA, during each semester: Single attempt only</p> <p>3. Marks: 50 Marks</p> <p>4. Duration: 1 Month or 4 Weeks – i) After end examination of semester 02 and before beginning of semester 03. or ii) Any one month during semester 02 duration</p> <p>5. Grading Criteria for Evaluation of OJT (or Intern) only by Mentor where the Internship is proposed to be imparted:</p> <table border="1"> <thead> <tr> <th>S N</th> <th>Parameters</th> <th>Marks Out of</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Behaviors, Shows interest in assigned work, Willingness to learn</td> <td>10</td> </tr> <tr> <td>2</td> <td>Accepts responsibility, Cooperates with co-workers and supervisors, Demonstrates organizational skills</td> <td>10</td> </tr> <tr> <td>3</td> <td>Uses time, knowledge and expertise effectively, Analyzes problems effectively</td> <td>10</td> </tr> <tr> <td>4</td> <td>Demonstrates creativity/ originality / any innovative contribution, Professional ethics and accountability</td> <td>10</td> </tr> <tr> <td>5</td> <td>Writes effectively, Produces high quality work/Skill Proficiency</td> <td>10</td> </tr> <tr> <td colspan="2">Total</td> <td>50</td> </tr> </tbody> </table> <p>Document as Evidence: Activity report along with Certificate or Declaration, duly issued and signed by the concerned authority [To be assessed during EE] should be submitted during End Examination to the parent Learner support Centre (LSC).</p>	S N	Parameters	Marks Out of	1	Behaviors, Shows interest in assigned work, Willingness to learn	10	2	Accepts responsibility, Cooperates with co-workers and supervisors, Demonstrates organizational skills	10	3	Uses time, knowledge and expertise effectively, Analyzes problems effectively	10	4	Demonstrates creativity/ originality / any innovative contribution, Professional ethics and accountability	10	5	Writes effectively, Produces high quality work/Skill Proficiency	10	Total		50	<p>At the end of second semester, Programme Coordinator (PC)/ Supervisor of LSC and 1 (one) External Examiner will complete 'End Exam (EE)' for all allotted students as follows:</p> <ol style="list-style-type: none"> Duration of EE: After Theory EE of second Semester Programme Coordinator (PC)/ Supervisor of LSC and External Expert will have 20% and 80% weightage respectively in EE. Number of attempts: Till Valid Registration Period (VRP) only Marks for EE: 50 Marks <table border="1"> <thead> <tr> <th>Parameter</th> <th>PC /Supervisor of LSC</th> <th>External Expert</th> </tr> </thead> <tbody> <tr> <td>Professional Attitude</td> <td>-</td> <td>05 Marks</td> </tr> <tr> <td>Maintenance of Daily Diary</td> <td>-</td> <td>10 Marks</td> </tr> <tr> <td>Internship Report</td> <td>05 Marks</td> <td>10 Marks</td> </tr> <tr> <td>Viva/Oral</td> <td>05 Marks</td> <td>15 Marks</td> </tr> <tr> <td>Total</td> <td>10 Marks</td> <td>40 Marks</td> </tr> </tbody> </table>	Parameter	PC /Supervisor of LSC	External Expert	Professional Attitude	-	05 Marks	Maintenance of Daily Diary	-	10 Marks	Internship Report	05 Marks	10 Marks	Viva/Oral	05 Marks	15 Marks	Total	10 Marks	40 Marks
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SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)									
6	Project Work (PW) RP-I 4 Credit 100 Marks CA: 50% EE: 50%	1. Student is required to submit “Activity Report” based on Grading Criteria of the course in the prescribed format. 2. Maximum number of attempts for each CA, during each semester: Single attempt only 3. Marks: 50 Marks 4. Grading Criteria: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>SN</th> <th>Desc</th> <th>Marks</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Seminar*</td> <td>25</td> </tr> <tr> <td>2</td> <td>Research Proposal</td> <td>25</td> </tr> </tbody> </table> <p>*To be conducted in Online/Offline mode at LSC.</p>	SN	Desc	Marks	1	Seminar*	25	2	Research Proposal	25	1. External and internal examiners shall assess each student based on: <ol style="list-style-type: none"> a. Project Report submission by the student (Only by External Examiner) [10 Marks] b. Project Presentation by the student [20 Marks] c. Viva-Voce on Project Report [20 Marks] 2. Number of attempts: Till Valid Registration Period (VRP) only 3. Marks: 50 Marks 4. Duration: 180 minutes
SN	Desc	Marks										
1	Seminar*	25										
2	Research Proposal	25										
		Evaluation of Project Work End Examination										
		S N	Description									
		Internal Examiner	External Examiner									
		1	Project Report									
		-	10 Marks									
		2	Project Presentation									
		05 Marks	15 Marks									
		3	Viva-Voce /Oral									
		05 Marks	15 Marks									
		4	Total									
		10 Marks	40 Marks									

SN	Type of Course	Continuous Assessment (CA)	End Examination (EE)												
7	Project Work (PW) RP-II 6 Credit 150 Marks CA: 50% EE: 50%	1. Student is required to submit “Activity Report” based on Grading Criteria of the course in the prescribed format. 2. Maximum number of attempts for each CA, during each semester: Single attempt only 3. Marks: 75 Marks 4. Grading Criteria: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>SN</th> <th>Desc</th> <th>Marks</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Seminar*</td> <td>30</td> </tr> <tr> <td>2</td> <td>Research Paper Presentation**</td> <td>30</td> </tr> <tr> <td>3</td> <td>Project Report</td> <td>15</td> </tr> </tbody> </table> <p>*To be conducted in Online/Off line mode at LSC. ** Journals/Conferences/ at LSC, in Online/Offline mode [This activity shall be organized by respective LSC in Online/Offline mode in case student didn't get an opportunity for presentation at Journals/Conferences]</p>	SN	Desc	Marks	1	Seminar*	30	2	Research Paper Presentation**	30	3	Project Report	15	1. External and internal examiners shall assess each student based on: <ol style="list-style-type: none"> Project Report submission by the student (Only by External Examiner) [20 Marks] Project Presentation by the student [25 Marks] Viva-Voce on Project Report [30 Marks] 2. Number of attempts: Till Valid Registration Period (VRP) only 3. Marks: 75 Marks 4. Duration: 180 minutes
SN	Desc	Marks													
1	Seminar*	30													
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		SN	Description												
		Internal Examiner	External Examiner												
		1	Project Report												
		2	Project Presentation												
		3	Viva-Voce /Oral												
		Total	15 Marks												
		-	20 Marks												
		05 Marks	20 Marks												
		10 Marks	20 Marks												
		15 Marks	60 Marks												

- Separate and independent passing @ 40% in CA, EE and (CA+EE) shall be essential for each course - Theory, Practical, OJT/FP and RP.** “CA, EE and Total marks” shall be separately reported for **each** course in the transcript or mark-statement. The minimum and maximum marks for “CA, EE and Total Marks” are shown in the table below. If student does not score a minimum of 40% marks in CA or in EE of a course then the result of such a course will be reported as FAIL.

Course Type	Number of Credits	Continuous Assessment (CA)		End Examination(EE)		Total Marks ‘TM’ = (CA +EE)	
		Min	Max	Min	Max	Min	Max
Theory	2	6	15	14	35	20	50
	4	12	30	28	70	40	100

Course Type	Number of Credits	Continuous Assessment (CA)		End Examination (EE)		Total Marks 'TM' = (CA + EE)	
Practical/ OJT/FP/RP	4	20	50	20	50	40	100
	6	30	75	30	75	60	150

2. In **each** semester, **only 1 attempt**, for CA for **each** course and for EE for **each** course shall be allowed. Only **during valid registration period (VRP)**, students are allowed to appear for CA and EE for **each** course against the payment of the specified 'Examination Fee' for each attempt, for each course where he/she is admitted by the university. The 'CA and/or EE' attempts are counted for each examination option offered by the university to the student, irrespective of whether student actually chooses to appear in end exam or not.
3. If a student does not successfully complete the continuous assessment (CA) or pass the End Examination of Practical/Term work/OJT/Field Project/Research Project courses, they may complete these requirements with the next semester at the respective Learning Support Center (LSC) **only** during the valid registration period (VRP).
4. **Duration for Practical/Term work/OJT/Field Project/Research Project type of Courses:** 180 Minutes for a batch of typically 15 ± 3 students
5. **Only best of past performance shall be reported in transcript or mark statement.**
6. **Total student evaluation for**
 - a. **Each** semester shall be for **550** marks
 - b. **Each** year shall be for **1100** marks
 - c. **Each** regular PG degree shall be for **2200** marks
7. **Reporting Semesters** for certification:
 - Min 40% or better marks in total 23 courses (subjects) of total 88 credit points at Semesters 01-04.

Successful Completion of Course or Programme

1. "Successful Completion of the Course" means - either course is exempted or student gets minimum specified or better grade, either in end examination of that course or by credit transfer. A student obtaining grade "F" shall be considered failed and will be required to reappear in the examination. The student obtained minimum "P" (Pass) letter grade required for successful completion of each course.
2. "Successful Completion of the Programme" means – all courses at all semesters are successfully completed and the student obtained "P" (Pass) letter grade for all courses at all semesters along with minimum specified SGPA and CGPA.

SEMESTER 01

ZOO501: Biochemistry

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology){2023} & V143: M.Sc. (Zoology){2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	DSC	ZOO501	Biochemistry	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: <ol style="list-style-type: none">Develop an understanding of biochemical basis of life.Explain Role of stabilizing interaction and bio-molecular complexity and biochemical processes as the foundation of all physiological events occurring in animals.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Biomolecules	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none">Very Short Answer Question (VSAQ), of 03 marksShort Answer Question (SAQ), of 05 marksLong Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
01-02	Amino Acids		
01-03	Proteins		
01-04	Protein Classification		
02-01	Structural Levels Of Protein	CR 02 MLs 21-40	
02-02	Analytical And Separation Techniques		
02-03	Sequencing		
02-04	Vitamins		
03-01	Enzyme	CR 03 MLs 41-60	
03-02	Enzyme Classification		
03-03	Enzyme Kinetics-I		
03-04	Enzyme Kinetics- II		
04-01	Introduction of Metabolism and Overview	CR 04 MLs 61-80	
	Bioenergetics		
04-02	Glycolysis And Gluconeogenesis		
04-03	Lipid Metabolism		
04-04	Protein Metabolism		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Biomolecules: Carbohydrates and lipids – Classification, structures and clinical significance	CR 01
1-2	Amino Acids: Amino acids and Peptides – Properties & structure Amino acids: Classification, Properties, rare amino acids.	
1-3	Proteins: Classification, structures and functions Nucleic acid and nucleotides – structure properties and function	
1-4	Protein Classification: Protein Classification, Reactions, functions, properties and Solid phase Peptide synthesis.	
2-1	Structural levels of protein: Primary Structure: Peptide bond, importance of primary structure Secondary structure: alpha-helix, β - structure, β -helix, super secondary structure, Ramachandran plot Tertiary Structure: Forces stabilizing, unfolding/ refolding expt. Prediction of tertiary Structure Quaternary structure – hemoglobin.	CR 02
2-2	Analytical and separation techniques: Analytical and separation techniques in biochemistry and biophysics. SDS PAGE Native PAGE Western Blot TLC HPLC End group analysis	
2-3	Sequencing: FDNB, PITC, Edman Degradation and LC-MS, LCMS-TOF	
2-4	Vitamins – Discovery, structure and function	
3-1	Enzyme: properties of enzymes, cofactors, nomenclature	CR 03
3-2	Enzyme classification: classification, iso enzymes and multi enzymes.	
3-3	Enzyme kinetics-I: One-substrate reactions, effect of pH, temperature, inhibitions, two substrate reactions.	
3-4	Enzyme kinetics- II: pre-steady state kinetics, stopped flow technique, relaxation methods.	
4-1	Introduction of metabolism and overview Bioenergetics: Basic law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, redox potentials, structure and significance of ATP	CR 04
4-2	Glycolysis and Gluconeogenesis: Detailed study energetics, regulation and significance. Citric acid cycle: Detailed study, energetics, regulation and significance. Electron transport and oxidative phosphorylation, ATP synthase and mechanism,	
4-3	Lipid metabolism: Types of fatty acid oxidation, energetics and regulation. Formation of ketone bodies, Biosynthesis of lipid, fatty acid synthase complex,	

	regulation of biosynthesis. Biosynthesis of triglycerides, cholesterol and phospholipids
4-4	Protein Metabolism: Peptides, polyamines, porphyrins, gamma glutamyl cycle, glutathione biosynthesis, Nucleotide metabolism: Biosynthesis, regulation and degradation of Purine and Pyrimidine nucleotides

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
ZOO501	Biochemistry, – Dr. V. R. Kakulte	2022	978-93-95855-09-9, YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO501:RB1	Biochemistry and Molecular Biology, - W. H. Elliott and D. C. Elliott, Oxford University press, New York, USA (Indian edition)	2001	0 19 870045 8
ZOO501:RB2	Metabolic Pathways, - Greenberg	3rd Edition 1970	9780323162135
ZOO501:RB3	Biochemistry, - L. Stryer, W.H. Freeman, San Francisco.	2008	978-1464126109
ZOO501:RB4	Biochemistry, – Stryer 3rd Edition W.H. Freeman and Co.	1988	978-1319114657
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO501:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO501:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Appreciate the foundation of life processes.
2. Explain the deep understand the structure of biomolecules.
3. Understand the thermodynamics of enzyme catalyzed reactions and mechanisms of energy production at cellular and molecular levels.
4. Understand the application of biochemistry.

ZOO502: Cell Biology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology){2023} & V143: M.Sc. (Zoology){2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	DSC	ZOO502	Cell Biology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B. Sc with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: <ol style="list-style-type: none">This course will give knowledge about organization of cell, its organelles and cell membranes, structure and cytoskeleton.It shall also provide knowledge about cell signaling, cell cycle and stem cells and various techniques used in cell biology.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	History And Basic Information Of Cell	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none">Very Short Answer Question (VSAQ), of 03 marksShort Answer Question (SAQ), of 05 marksLong Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
01-02	Cell Organization		
01-03	Bio Membranes		
01-04	Membrane Transport		
02-01	Nucleus	CR 02 MLs 21-40	
02-02	Mitochondria		
02-03	Endoplasmic Reticulum		
02-04	Golgi Complex		
03-01	Cell Surface Receptors	CR 03 MLs 41-60	
03-02	Cell Junctions		
03-03	Cell Adhesion Molecules		
03-04	Cytoskeleton		
04-01	Cell Cycle	CR 04 MLs 61-80	
04-02	Cell Division		
04-03	Apoptosis		
04-04	Cancer		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	History and Basic information of cell: Discovery of cell, cell theory, prokaryotes and eukaryotes, evolution of eukaryotic cell.	CR 01
1-2	Cell organization: Structural organization of virus, bacteria and eukaryotic cell- ultra structure of animal cell.	
1-3	Bio membranes: chemical composition and molecular arrangement (lipid bilayer, membrane proteins and carbohydrates), models of membranes (fluid mosaic).	
1-4	Membrane Transport: Diffusion (simple and facilitated) and active transport (primary and secondary), carrier proteins (uni, sym and anti porters), channel proteins (voltage and ligand gated). Bulk transport-pino, phago and exocytosis. Receptor mediated endocytosis	
2-1	Nucleus: Introduction of cell Organelles, Nucleus components, nuclear pore complex, organization of chromatin nucleosomes, chromosomes, export and import of proteins.	CR 02
2-2	Mitochondria: Mitochondria structure & functions.	
2-3	Endoplasmic reticulum: signal peptide hypothesis, insertion of membrane proteins and glycosylation .	
2-4	Golgi Complex: secretory and lysosomal proteins, Glycosylation of proteins.	
3-1	Cell Surface receptors: G-protein linked receptors, signal transduction, second messengers, receptor tyrosine kinase and intracellular receptors.	CR 03
3-2	Cell junctions: tight junction, desmosomes, hemidesmosome and gap junctions.	
3-3	Cell adhesion molecules: cadherins, Immunoglobulin like molecules, integrins and selectins.	
3-4	Cytoskeleton: Microtubules, microfilaments and their dynamics, Centrosome, cilia, flagella. Mitotic apparatus and movement of chromosomes.	
4-1	Cell cycle: Phases of cell cycle, Regulation of cell cycle: Discovery of MPF, cyclins and cyclin dependent kinase, Check points- role of Rb and p53.	CR 04
4-2	Cell division: Mitosis-Chromosomal condensation cycle, Cytokinesis, Centrioles; Meiosis- Structural aspects of Synaptonemal Complex, Significance of Crossing over.	
4-3	Apoptosis: Neuro trophic factors, caspases, Pathways of apoptosis.	
4-4	Cancer: Introduction, Molecular basis of Cancer, Cell Differentiation, Mutations effecting cellular process, Accumulation of mutation, Cell proliferation, Genomic instability, Familial cancers, proto oncogene, Tumor	

Suppressor genes.

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO502	Cell Biology, - Mr. Shantaram B. Bhoje	2022	978-93-95855-10-5 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO502:RB1	Cell Physiology : A Molecular approach, -Sperelakis	2001	978-1605357461 Academic Press, New York, USA.
ZOO502:RB2	Molecular Cell Biology, - W.H. Freeman and Company, New York, USA Lodish et. al.	5 th edition 2008	978-0815341055
ZOO502:RB3	Molecular Biology of the Cell, -Alberts et. al	2008	978-1429203142 Garland Science, Taylor & Francis Group, New York, USA.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO502:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO502:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Explain the transport across cell, nuclear membrane; bioenergetics and metabolism.
2. Define the composition and organization of cytoskeleton.
3. Enumerate and explain signaling molecules and their receptors. How the cell cycle is regulated? The students will have an idea of stem cells and its applications.
4. Basic principles and application of microscopy, cell culture and flow cytometry.

ZOO503: Applied Zoology Part - I

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology){2023} & V143: M.Sc. (Zoology){2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	DSC	ZOO503	Applied Zoology Part – I	2	6	60	15	35	50	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B. Sc with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> To analyse the relationships among animals, plants and microbes. To understand the applications of biological sciences in Lac culture, Sericulture, Apiculture, Aquaculture, Poultry and Vermicomposting. To explain the tools and techniques used in various cultures. To explain the modifications and adaptations in animal.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Aquaculture	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
01-02	Maintenance Of Physicochemical Parameter For Fish Culture		
01-03	Fish Breeding		
01-04	Construction And Management Of Fish Culture Pond		
02-01	Pearl Culture	CR 02 MLs 21-40	
02-02	Apiculture		
02-03	Life History Of Honey Bees		
02-04	Lac Culture		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
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1-1	Aquaculture: Concept and its scope, Types of Aquaculture, Fresh water, Marine, riverine and lacustrine fishes, Status of Aquaculture practices in India.	CR 01
1-2	Maintenance of Physicochemical parameter for fish culture: pH, Calcium, Total Alkalinity, Nitrate, Ammonia, Total hardness of water, DO etc.	
1-3	Fish breeding: natural and induced, Transport of fish seed and Brood and Fish culture.	
1-4	Construction and management of fish culture pond: Construction and management of ponds, Predatory and weed fishes and their control, Aquatic weeds and their control, Aquatic insects and their control, fish feeding: natural and artificial water level etc.	
2-1	Pearl Culture: Importance of pearl culture; methods of pearl culture, Aquarium maintenance.	CR 01
2-2	Apiculture : importance of Bee keeping, Apiculture, bee hive, social life of honey bee, properties of honey	
2-3	Life history of honey bees: Life history of honey-bee, Types of honey bees, Economic importance of honey bee.	
2-4	Lac culture: Lac insect and its biology, rearing of Lac insects, collection and processing of Lac	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO503	Applied Zoology Part – I, - Dr. A. J. Dhembare	2022	978-93-95855-11-2 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO503:RB1	An Introduction to Sericulture Unknown Binding - M. Madan Mohan Rao	2019	B.S. Publish
ZOO503:RB2	Aquaculture -John, E. Bardach, John H. Ryther, W.O. Mclamey,	1974	John Willey and Sons, New York.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO503:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO503:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms.
2. Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.

ZOO504: Lab on Biochemistry, Cell Biology & Applied Zoology Part-I

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology){2023} & V143: M.Sc. (Zoology){2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	DSC	ZOO504	Lab on Biochemistry, Cell Biology & Applied Zoology Part-I	4	12	120	50	50	100	P

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B. Sc with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Demonstrate knowledge and understanding of the molecular machinery of living cells. Demonstrate knowledge and understanding of the principles that govern the structures of macromolecules and their participation in molecular recognition. Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules. Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules.

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit {Activity updated as per SLM Lab Manual on 24 Feb 2024} [More Activities will be added]	CR
Biochemistry		
1-1	Proteins determination	CR 01
1-2	Glucose determination	
1-3	Lipids determination	
1-4	Estimation of Amino acid	
2-1	Estimation of carbohydrates (sugar)	CR 02
2-2	Determination of enzyme activities of SDH and LDH	

2-3	Effect of substrate concentration and pH on SDH activity	
Cell Biology		
2-4	Study of Sub-cellular fractionation: nuclei, mitochondria Cytosol & assaying functional identification of mitochondria	
3-1	Study and describe the Mitosis: Effect of colchicine on mitosis	CR 03
3-2	Study and Preparation of blood smears: Cell type identification and differential counts	
3-3	Study of Phagocytosis	
3-4	Study of Pinocytosis	
4-1	Study of EM – interpretation of cellular ultra structure	CR 04
Applied Zoology Part-I		
4-2	Study of morphology, general characters and life cycle of Insect	
4-3	Study and Identification of Silkworms	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	Publication No.
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO504	Lab on Biochemistry, Cell Biology & Applied Zoology Part – I, - Mr. Ashutosh Nirbhavane, Mr. Amol Pund, Mr. Sachin Jangam	2022	2503 & 2504 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO504:RB1	Practical Biochemistry– Principles and Techniques, Wilson and Walker,	2019	Cambridge Univ. Press, Cambridge, UK B.S. Publish
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO504:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO504:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Frame a scientific question or problem.
2. Undertake investigations and perform analyses about biochemical problems.
3. The structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles

RES505: Research Methodology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V151: M.Sc.(Mathematics) {2023 Pattern}, V152: M.Sc.(Environmental Science) {2023 Pattern}, V153: M.Sc.(Physics) {2023 Pattern}, V154: M.Sc.(Chemistry) {2023 Pattern}, V155: M.Sc.(Zoology) {2023 Pattern}, V156: M.Sc.(Botany) {2023 Pattern},

COURSE INFORMATION

Sem	Other	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	RM	RES505	Research Methodology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> To Introduce Research Methodology. To study data collection & representation methods. To demonstrate statistical tools for data analysis. To discuss Literature collection, Intellectual Property Rights, and plagiarism.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Research Methods In Research Experimental Design Sampling Method	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Data Collections Representation Of Data Graphical Representation Analysis Of Data	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks
03-01 03-02 03-03 03-04	Use Of Inferential Statistical Tools In Research Biostatistical Test Use Of ANOVA Application Of Correlation Of Data	CR 03 MLs 41-60	<ul style="list-style-type: none"> Short Answer Question (SAQ), of 05 marks Long Answer

04-01	Literature Collection	CR 04 MLs 61-80	Question (LAQ) of 10 Marks
04-02	Intellectual Property Rights		(LAQ may contain sub-questions (a), (b) and so on.)
04-03	Research Databases		
04-04	Research Metrics		

Important Note: This course is common across all Postgraduate Programmes in the ‘School of Sciences’, the content within the Research Methodology course should incorporate illustrations and examples relevant to their respective domains or disciplines.

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Research: Basic and applied research, essential steps in research, Research – definition, importance and application.	CR 01
1-2	Methods in research: General methods in research – natural observation, field study, and experimentations.	
1-3	Experimental design – Basic principles, hypothesis, one & two group experimental design. Matched pair data analysis, factorial design, randomized block design.	
1-4	Sampling method - Concept of population, random sampling and non random sampling, variables – random, independent and intervening variables.	
2-1	Data collections: Methods for primary data- observation, interview, questionnaire methods, and experiments, Methods for secondary data – scientific journals, books, reports, databases.	CR 02
2-2	Representation of data: Tabular representations of quantitative data, frequency table – one way and two way.	
2-3	Graphical representation: Graphical representation of quantitative data – line graph, histogram, frequency polygon, frequency curve, Ogive, bar diagrams and pie diagrams.	
2-4	Analysis of data – Tools of statistics and software applications.	
3-1	Use of inferential statistical tools in research: Use of different statistical estimations depending on the type of data, hypothesis testing, and test of significance.	CR 03
3-2	Biostatistical Test: Student’s ‘t’ test – applications and importance in research data And Application of Chi-square test for the experimental data	
3-3	Use of ANOVA: (one-way and two-way ANOVA) for the research data analysis.	
3-4	Application of correlation of data: Application of correlation and regression analysis for the data.	
4-1	Literature collection: Need, review process, consulting source material, literature citation; Components of research report – Text, tables, figures, bibliography, Writing of dissertations, project proposals, project reports, research papers.	CR 04
4-2	Intellectual Property Rights: Basics of patent, Types of Patents (patents, copyrights, trademarks, Geographical Indications, Industrial Designs, and traditional knowledge, Patent application process (Searching a patent, Drafting a patent, Filing of patent, Types of patent applications), Patent documents	

	(Specifications and Claims).	
4-3	Research Databases: Types of Databases- Indexing Databases and benefits of Indexing, Citation Index Database; Major Citation Indexing Services - Web of Science /Web of Knowledge (WoS/WoK), Scopus/Science Direct, Google Scholar, Cite Seer X, World Wide Science(WWS), IEEE Xplore, PubMed Central (PMC) Database, Directory of Open Access Journals (DOAJ), Indian Citation Index (ICI) Database, E-Theses Online Service (EThOS), Preprint site arXiv [Refer Chapter 13 of Academic Integrity and Research Quality]	
4-4	Research Metrics: Journal Metrics- Impact Factor (IF) or Journal Impact Factor(JIF), List of Impact Factor of Various Journals, Problems of the Impact Factor and the Editorial Ethics, Cite Score, Difference between Cite Score and Impact Factor, Impact Per Publication (IPP); Newly Emerged Indicators - Source Normalized Impact Per Paper (SNIP), Sc imago Journal Rank (SJR), Eigen factor, Article Influence, SC Imago Journal; Author level Metrics- H-Index with its Advantages and limitations, G-Index, i10/20 Index; Altmetrics with its Advantages and limitations; Unique ID for Research Contributors/Author. [Refer Chapter 13 and 14 of Academic Integrity and Research Quality]	
Self-Study	Laboratory safety: Biohazardous agents, biosafety levels, lab acquired infections, other hazards; Laboratory good practices. Animal model systems: animal ethics- animal welfare guidelines for care and use of animals.	No Marks

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
RES505	Research Methodology, -Dr. A. J. Dhembare	2022	9789395855-62-4, YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
RES505:RB1	Research Methodology, - R C Kothari	2019	978-9386649225 New age Inter. Publication
RES505:RB2	Research Methodology, - Dr. Harish Purohit; Dr. Ajay Singh; Dr. Ashutosh Singh; Dr. Vinayaka K. S.	2023	9789355158567 Book Rivers
RES505- RB3	Academic Integrity and Research Quality (Chapter 13 and 14)	Dec 2021	e-Books , UGC web site
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
RES505:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			

RES505-WL1	Academic Integrity and Research Quality	Dec 2021	e-Books , UGC web site
RES505- WL2	Guidance Document: Good Academic Research Practices	Sept 2020	e-Books , UGC web site

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Understand some basic concepts of research and its methodologies.
2. Select proper method of Data collection & representation.
3. Select and apply appropriate statistical method for data analysis.
4. Do literature review, research writings with the knowledge of Intellectual Property Rights.

Elective Courses

ZOO506: Developmental Biology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	DSE	ZOO506	Developmental Biology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: <ol style="list-style-type: none">In this subject students will gain a detailed understanding how an organism develops.Biochemical and cellular events that regulate the development of specialised cells, tissues and organs during embryonic development.How a single cell becomes an organized grouping of cells that is then programmed at specific times to become specialized for certain tasks.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Scope And Importance Of Developmental Biology	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none">Very Short Answer Question (VSAQ), of 03 marksShort Answer Question (SAQ), of 05 marksLong Answer Question (LAQ) of
01-02	Fertilization		
01-03	Cleavage		
01-04	Role Of Cytoplasm		
02-01	Cell-Cell Interaction And Cell Signaling	CR 02 MLs 21-40	
02-02	Special Early Embryonic Development-I		
02-03	Early Embryonic Development-II		
02-04	Early Mammalian Development		
03-01	Late Embryonic Development	CR 03 MLs 41-60	
03-02	Sex Determination		
03-03	Differentiation:		
03-04	The Development Of Blood Cells		

04-01	Gastrulation	CR 04 MLs 61-80	10 Marks
04-02	Concept Of Organizers And Induction		(LAQ may contain sub-questions (a), (b) and so on.)
04-03	Metamorphosis		
04-04	Teratogenesis		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Scope and importance of developmental biology: Gametogenesis; spermatogenesis, Oogenesis, vitellogenesis and chemo-differentiation.	CR 01
1-2	Fertilization: Fertilization, parthenogenesis and its significance	
1-3	Cleavage: Types of cleavage, mechanism of cleavage, chemical changes during cleavage	
1-4	Role of cytoplasm: Role of cytoplasm and nucleus during early development; morphogenetic movements, presumptive areas and fate maps	
2-1	Cell-cell interaction and cell signaling: Cell-cell interaction and cell signaling during morphogenesis in early embryo; gastrulation, neurulation and primordial organ rudiments, Origin and fate of neural crest cells.	CR 02
2-2	Early Embryonic Development-I: Introduction to Embryonic Development: Structure of Gametes, Recognition of Egg and Sperm, Acrosomal Reaction.	
2-3	Early Embryonic Development-II: The Early Development of Snails, The genetics of axis formation in Drosophila	
2-4	Early Mammalian Development: Mammalian Anterior-Posterior Axis Formation, Dorsal-Ventral and left-Right Axes in Mammals.	
3-1	Late Embryonic Development: Tetrapod limb Development, Metamorphosis, Regeneration and Aging.	CR 03
3-2	Sex Determination: Sex Determination approaches in Developmental Biology	
3-3	Differentiation: Cellular basis of differentiation, trans-differentiation, Metaphase and Regeneration. Stem cells and their role in development.	
3-4	The Development of Blood Cells: The Stem Cell concept, the Pluripotential hematopoietic stem cells, Blood and lymphocyte lineages, Hematopoiesis	
4-1	Gastrulation: Gastrulation, metabolic events during gastrulation and rudimentary organs Formation	CR 04
4-2	Concept of organizers and induction: Neural tubule formation, Organogenesis: limb, central nervous system, heart, kidney and eye.	
4-3	Metamorphosis: Role of hormones in metamorphosis of insects and frog; regeneration in Cnidaria, Echinodermata, Amphibia-limb and tail regeneration, and Reptiles-tail regeneration.	
4-4	Teratogenesis: genetic and environmental; developmental mechanisms of teratogenesis	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
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Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination

Text-Books

ZOO506	Developmental Biology, - Dr. R. B. Andhale	2022	YCMOU
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Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!

ZOO506:RB1	Developmental Biology, -Gilbert, (8th Ed.)	2006	978-0805368444 Sinauer Associates Inc., Massachusetts, USA.
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ZOO506:RB2	Analysis of Biological Development, -Kalthoff, (2nd Ed.)	2000	978-1605356044 McGraw-Hill Science, New Delhi, INDIA.
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CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!

ZOO506:CD1			
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Web Links: Explore additional details and reinforce learning, with this optional learning resource!

ZOO506:WL1			
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COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Explain the molecular and genetic background of animal and plant development.
2. Describe evolutionary history of complex multicellular life forms.
3. Compare environmental influence on development and homeostasis of animals and plants.

ZOO507: Entomology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	DSE	ZOO507	Entomology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Develop the ability to design and perform a scientific study on insects, and Morphology and Systematic. Develop an understanding about the Insect Ecology and Integrated Pest Management Including Beneficial Insects. Crop Pests and Stored Grain Pests and Their

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	External Morphology Study of Generalized insects Insect taxonomy I Insect taxonomy II Insect Behavior	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks
02-01 02-02 02-03 02-04	Pest of field crops and storage grains Horticultural crop pests Integrated pest management I Integrated pest management II	CR 02 MLs 21-40	(LAQ may contain sub-questions (a), (b) and so on.)
03-01 03-02 03-03 03-04	Internal Morphology I Internal Morphology II Internal Morphology III Livestock entomology	CR 03 MLs 41-60	
04-01 04-02 04-03 04-04	Urban Entomology Medical Entomology Forensic Entomology Aquatic Entomology	CR 04 MLs 61-80	

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	External Morphology Study of Generalized insects: Head, Thorax, Appendages (Mouthparts, Antennae, Leg of insects, General Characters of wings of insects, wing variation).	CR 01
1-2	Insect taxonomy I: Character and classification of phylum Arthropod, Character and Classification of class insect, Character of insect orders (Thysanura, Collembola, Odonata, and Orthoptera).	
1-3	Insect taxonomy II : Character and classification of class insect, Character of insect orders (Isoptera, Coleoptera, Diptera, Lepidoptera, Hymenoptera)	
1-4	Insect Behavior : Pattern of behavior (innate behavior, Learning), Communication and modes of communication, Courtship and mating behavior, Copulation, Migration, Feeding behavior, Social behavior, Escape behavior, Defense behavior, Clocks and circadian rhythms, Diapauses.	
2-1	Pest of field crops and storage grains : Pest of rice, Pest of Millets, Pest of sugarcane, pest of groundnut, pest of castor, pest of cotton, pest of chilies, pest of red gram, Coleopteran pests of stored Grains, Lepidopteron [pests of stored grains, Storage pest management.	CR 02
2-2	Horticultural crop pests: Pest of Brinjal, Pest of tomato, Pest of mango and Pest of citrus.	
2-3	Integrated pest management I : Definitions, Aims of IPM, Ecology and IPM	
2-4	Integrated pest management II: Principles of IPM, Component (Tools) of IPM<Curative measures (Mechanical control, Biological control, Microbial control. Chemical control, Achievements in IPM.	
3-1	Internal Morphology I: Integument (cuticle, Epidermis, Basement Membrane, chitin), Endocrine system.	CR 03
3-2	Internal Morphology II: Digestive system, Excretory system, Circulative system	
3-3	Internal Morphology III: Respiratory system, Nervous system, Reproductive system	
3-4	Livestock entomology : Insect associate with Cattle(horse fly, stable fly, Cattle fly, Blow fly, Ox warble fly, House fly, Blood Sucking Sand flies, Eye flies, Eye Frequenting Moths, Insects Associated with Poultry.	
4-1	Urban Entomology: Introduction, Termites, (character, Classification of termites, cast of Termites, Feeding Habits, Habitations of termites, Control) Cockroaches (Character, Biology, Economic Importance, control), Ants (Biology, Economic importance, control).	CR 04
4-2	Medical Entomology : Introduction to medical Entomology, Insect of Medical Importance (Mosquitoes, Sand flies, the housefly, Bed bug, Fleas, Human Body Louse.	
4-3	Forensic Entomology: Introduction to forensic entomology, scope of forensic entomology history of Forensic entomology in wildlife investigation, process after death, Estimating time of death	
4-4	Aquatic Entomology: Introduction, Taxonomic Position of Aquatic insects, Respiration in Aquatic insects, Aquatic Locomotion.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO507	Entomology, - Dr. V. R. Kakulte	2022	978-93-95855-68-6 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO507:RB1	The Insects: Structure and function, -Chapman, R. F.	2013	9780199734825 Cambridge University Press, UK
ZOO507:RB2	The Insects, An outline of Entomology -Gullan, P. J. , and Cranston	2014	978-1444330366 P. S., Wiley Blackwell, UK
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO507:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO507:WL1			
COURSE OUTCOMES			
<p>After successful completion of this course, student should be able to:</p> <ol style="list-style-type: none"> 1. To study the physiology of male and female reproductive axis and reproductive cycles. 2. To develop understanding of endocrinology of pregnancy, parturition and lactation. 3. To understand the interrelationship between reproduction and immunity. 4. To study the seasonality in reproduction. 			

SEMESTER 02

ZOO509: Molecular Biology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	DSC	ZOO509	Molecular Biology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: <ol style="list-style-type: none">To understand the molecular basis of genetic processes.The DNA structure & types, chromatin structure and organization.The course will provide an insight into the life processes at the sub-cellular and molecular levels.Other important aspects of molecular genetics including gene cloning, sequencing and gene mapping.Use genetic engineering (recombinant DNA technology) to isolate, sequence.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Nucleic Acids DNA structure and Topology DNA as genetic material Genome organization	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Replication Transcription and Regulation Post transcriptional modifications Gene Regulation	CR 02 MLs 21-40	<ul style="list-style-type: none">Very Short Answer Question (VSAQ), of 03 marksShort Answer Question (SAQ), of 05 marks
03-01 03-02 03-03 03-04	Translation Synthesis Post translational modifications DNA repair mechanism	CR 03 MLs 41-60	<ul style="list-style-type: none">Long Answer Question (LAQ) of

04-01	Molecular techniques	CR 04 MLs 61-80	10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
04-02	Blotting techniques		
04-03	Protein sequencing method		
04-04	Molecular Techniques		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Nucleic Acids: Nucleic Acids and Chromatin, Structure of RNA & DNA. Types of RNA.	CR 01
1-2	DNA structure and Topology: Structure of chromatin, nucleosome, chromatin organization and remodeling, higher order organization - chromosome, centromere, telomere, Histones and its effect on structure and function of chromatin, type of DNA (A,B,Z)	
1-3	DNA as genetic material: DNA as genetic material - evidences Griffith's, Avery et al., Hershey and Chase experiment, RNA as genetic material - TMV 4.	
1-4	Genome organization: C value paradox and genome size, Cot curves, repetitive and non-repetitive DNA sequence and their importance Cot 1/2 and, kinetic and sequence complexity, satellite DNA.	
2-1	Replication: DNA Replication (in prokaryotes and eukaryotes), and recombination, Genome of prokaryotes, vertebrates and human.	CR 02
2-2	Transcription and Regulation: Types of RNA, secondary and tertiary, structure and function Transcription in prokaryotes, eukaryotes, RNA polymerases	
2-3	Post transcriptional modifications: Post transcriptional modifications-RNA splicing and processing (5' capping, Poly Aadenylation), mRNA editing, inhibitors of transcription, reverse transcription, Mitochondrial translation.	
2-4	Gene Regulation: Regulation of gene expression, Lac Operon, Arabinose Operon, tryptophan Operon.	
3-1	Translation: Translation and Regulation, Ribosome structure, Genetic code (codon anticodon recognition, wobble hypothesis, mutations)	CR 03
3-2	Synthesis: Polypeptide synthesis, initiation, elongation, termination, control of eukaryotic translation, Effect of antibiotics on protein synthesis,	
3-3	Post translational modifications: Post translational modifications, protein folding, protein sorting, Mitochondrial translation, proteomics and proteomic analysis	
3-4	DNA repair mechanism: Photo repair, dark repair, base excision repair.	
4-1	Molecular techniques: Isolation and purification of RNA, DNA (genomic and plasmid) and proteins; their analysis by one and two dimensional gel electrophoresis, iso-electro focusing gels.	CR 04
4-2	Blotting techniques: Southern (DNA), Northern (RNA), Dot blotting and Western (proteins).	
4-3	Protein sequencing method: Protein and DNA sequencing methods, strategies of genome sequencing, microarrays.	
4-4	Molecular Techniques: DNA fingerprinting, PCR principle, DNA polymerases RFLP, RAPD and AFLP techniques, FISH.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO509	Molecular Biology, - Dr. Sujata Magdum	2022	978-93-95855-66-2 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO509:RB1	Molecular Biology of the Gene, -Watson et al., (5 th Ed.)	2004	978-0815341055 Pearson Education, Delhi, INDIA
ZOO509:RB2	Genes IX, GENES VIII, -Lewin, (9 TH Edition),	2008	978-9351341802 Jones and Bartlett Publishers, Boston, USA
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO509:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO509:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Understand molecular processes viz. Replication, transcription, translation etc.
2. Underlying survival and propagation of life at molecular level.
3. Understand how genes are ultimately expressed as proteins which are responsible for the structure and function of all organisms.
4. Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms.

ZOO510: Genetics

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	DSC	ZOO510	Genetics	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Human genetics will impart knowledge about the human chromosome constitution that would help in applying basic principles of chromosome behavior to disease context. To create awareness of genetic diseases.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Introduction to genetics Gene Inheritance Multiple alleles Genome organization	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Mutation Types of point mutation Mutagenic agents Sex-determination	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks
03-01 03-02 03-03 03-04	Population Genetics Hardy-Weinberg principles Linkage and mapping in eukaryotes Genetic disorders	CR 03 MLs 41-60	<ul style="list-style-type: none"> Short Answer Question (SAQ), of 05 marks
04-01 04-02 04-03 04-04	Sex linked inheritance Microbial Genetics Application genetics Breeding technology	CR 04 MLs 61-80	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
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1-1	Introduction to genetics: Classical and Modern concept of Genetics, Cistron, Muton, Recon. Mendel's laws of Inheritance.	CR 01
1-2	Gene Inheritance: Exceptions to Mendelian Inheritance, Incomplete dominance, complete dominance, Co dominance, Heritability, Epistasis.	
1-3	Multiple alleles: Concept, characteristics and importance of multiple alleles, ABO & Rh - blood group system and its medico legal importance.	
1-4	Genome organization: Genome organization in viruses, prokaryotes and eukaryotes Organization of nuclear and organelles genomes; C-value paradox, Repetitive DNA-satellite DNAs and interspersed repeated DNAs, Transposable elements, LINES, SINES, Alu family and their application in genome mapping.	
2-1	Mutation: Gene Mutation: Definition. Types of mutations: spontaneous, induced, somatic, Gametic, forward, reverse. Types of point mutation - deletion, insertion, substitution, transversion, transition.	CR 02
2-2	Types of point mutation: Deletion, Insertion, Substitution, Transversion, Transition.	
2-3	Mutagenic agents: a) UV radiation and ionizing radiation. b) Base analogs, alkylating and intercalating agents.	
2-4	Sex-determination: Sex-determination, Introduction, Types of sex determination: -XX-XY, ZZ-ZW, XX-XO and Parthenogenesis, Hypodiploidy, Gynandromorphism.	
3-1	Population Genetics: Basic Concepts in population genetics: Mendelian population, gene pool, gene / allele, Frequency, chance mating (Panmictic Zooing).	CR 03
3-2	Hardy-Weinberg principles: Hardy-Weinberg principles and applications, Changes in allelic frequencies, Exercises for solving population genetics problems.	
3-3	Linkage and mapping in eukaryotes: Detection of linkages, construction of linkage maps in diploids and their characteristics, Co-efficient of Coincidence, Outline of other mapping techniques	
3-4	Genetic disorders: Concept of Genetic disorders, Structural & numerical alterations of chromosomes (chromosomal aneuploidy - Down, Patau, Edward, Turner and Klinefelter syndromes).	
4-1	Sex linked inheritance: Sex linked inheritance in human, Colour – blindness, Haemophilia, Hypertrichosis.	CR 04
4-2	Microbial Genetics: Recombination in bacteria and gene mapping, Transformation, Conjugation, Transduction-Generalized and Specialized, Fine structure mapping of genes General principles and genetics of bacteriophages :T-even and T-odd, RNA Phage, Mu and transposons	
4-3	Application genetics: Genetic counseling	
4-4	Breeding technology: Diagnostics & breeding technology, Inbreeding and	

	consequences, Co-efficient of inbreeding and consanguinity.	
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LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO510	Genetics, - Dr. Sujata Magdum	2022	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO510:RB1	Principles of Genetics (4th Ed), -P. D. Snustad, M. L. Simmons J. B. Jenkins	1997 2005	John Wiley & Sons, USA
ZOO510:RB2	Genetics, , 9 th Ed., -Verma P. S. and Agarwal V. K.,	2014	9789352535255 S. Chand and Co., New Delhi.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO510:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO510:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Aware about genetic diseases, their types and causes.
2. Understand molecular techniques that provide improvement, diagnosis and management of these diseases.
3. The principles of inheritance, linkage and crossing over which lead to variations will be made clear as well as the application thereof in gene mapping.

ZOO511: Applied Zoology Part-II

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	DSC	ZOO511	Applied Zoology Part-II	2	6	60	15	35	50	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	Objectives of this course are: <ol style="list-style-type: none"> Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied Zoology.

UNITS

UN	Name of the Unit {Updated as per SLM Book on 24 Feb 2024}	CSs	Questions
01-01 01-02 01-03 01-04	Sericulture Life Cycle Of <i>Bombyx Mori</i> Cultivation Cocoons	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
02-01 02-02 02-03 02-04	Vermi-Culture And Vermi Compost Domestic Animals Dairy Farming Prawn/Shrimp Farming	CR 02 MLs 21-40	

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit {Updated as per SLM Book on 24 Feb 2024}	CR
1-1	Sericulture: Introduction to Sericulture, Types of silk moths, their distribution, Taxonomic position and varieties of silk produced in India: Mulberry, Tasar silk, Eri silk and Muga silk moths.	CR 01
1-2	Life cycle of <i>Bombyx mori</i>: External Morphology and life cycle of <i>Bombyx</i>	

	<i>mori</i> .	
1-3	Cultivation: Cultivation of mulberry, Harvesting of mulberry, Silk worm rearing.	
1-4	Cocoons: Preparation of cocoons for marketing, Post harvest processing of cocoons, Biotechnological and biomedical applications of silk.	
2-1	Vermi-culture and Vermi Compost: Introduction, ecology and distribution of earthworms, Vermicomposting Methods.	CR 02
2-2	Domestic animals:- Animal husbandry and Poultry, Goat/Sheep/ Pig farming	
2-3	Dairy Farming: Dairy product and chemistry of milk, common cattle diseases.	
2-4	Prawn/shrimp farming: introduction to prawn/ shrimp farming, pond design and construction, prawn farming (pond management), disease control and prevention	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO511	Applied Zoology Part-II, - Dr. A. J. Dhembare	2022	978-93-95855-11-2 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO511:RB1	Developmental Biology, -Gilbert, S.F. 10 th Edition	1993	978-9814636124 Sinauer Associated Inc., Massachusetts
ZOO511:RB2	Essential Developmental Biology, 4th Edition - Jonathan M. W. Slack, Leslie Dale	2021	1119512859 Wiley-Blackwell
ZOO511:RB3	Development Biology, - Berril, N.J. and Karp, G.	1976	978-0070050204 McGraw Hill, New York
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO511:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO511:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Understands about parasites and epidemiology of parasites in human and animals.
2. Use of recombinant DNA technology in genetic manipulations and in a variety of industrial processes.

ZOO512: Lab on Molecular Biology, Genetics & Applied Zoology Part-II

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	DSC	ZOO512	Lab on Molecular Biology, Genetics & Applied Zoology Part-II	4	12	120	50	50	100	P

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. With or equivalent from a recognized University/Board. 	<p>Course objectives are:</p> <ol style="list-style-type: none"> To provide with the core principles of molecular biology. To gain higher level thinking skills that is necessary for scientists. How certain qualities or traits are passed from parents to offspring as a result of changes in DNA sequence. Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit {Activity updated as per SLM Lab Manual on 24 Feb 2024}	CR
Molecular Biology		CR 01
1-1	To isolate, quantitation genomic DNA from goat liver and agarose gel electrophoresis	
1-2	Genomic DNA isolation from prokaryotic cells	
1-3	Study and Demonstration of plasmid DNA in <i>E. coli</i>	
1-4	Quantification of RNA and agarose gel electrophoresis	
2-1	Protein gel electrophoresis	CR 02
Genetics		
2-2	Multiple alleles- Blood group	
2-3	Mendel's laws-Monohybrid and Dihybrid ratios	

3-1	Hardy Weinberg Law	CR 03
3-3	Gene Frequency Karyotyping	
Applied Zoology Part-II		
4-1	To Demonstrate the Practices of sericulture	CR 04
4-2	Identification and classification of Honey Bee species	
4-3	Study of morphology and Identification of fishes	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	Publication No.
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO512	Lab on Molecular Biology, Genetics & Applied Zoology Part-II, – Mr. Rahul Navale, Mr. Amol Pund & Mr. Amol Pund, Mr. Sachin Jangam	2022	2504 YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO512:CD1	Molecular Biotechnology: Principles and application of recombinant DNA, -Bernard R. and Jack,	2003	ASM Press, Herndon, USA
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO512:WL1			

COURSE OUTCOMES

Objectives of this course are:

1. Students will demonstrate ability to use evolutionary theory and related equations to model and predict population change or stability.
2. The student will gain a basic understanding on human genetics and hereditary.
3. Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms.

ZOO513: On Job Training (OJT)

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology)

COURSE INFORMATION

Sem	Other	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	OJT	ZOO513	On Job Training	4	12	120	50	50	100	TW

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	The objectives of this course are: <ol style="list-style-type: none">To provide hands-on experiences.To provide an effective training environment to students.To provide opportunities for students to apply theories and principles learned in class to real job settings.To bridge the gap between academia and the professional world.To promote research and innovation.

DETAILS ABOUT ON-JOB-TRAINING (OJT)/INTERNSHIPS

Internships offer valuable opportunities for postgraduate students to bridge the gap between academia and the professional world, promote research and innovation.

By engaging in hands-on experiences and collaborating with experts, students can develop practical skills, expand their network, and gain insights into potential career paths.

GUIDELINES: [IN PROCESS]

A. General:

- 1) It is mandatory for a student to successfully complete the OJT (Internship) for the award of the PG Diploma / PG Degree. This internship could be the research internship or any normal industry, Organization/Institute, Start-up/ ATAL Innovation/Incubation centers, Micro/Small/Medium/Enterprise, Govt. /NGO/PSU/, Online/offline academic activities at School/Regional Centers/ University Head Quarters, Online Internship related to major courses.
- 2) In case of working students and his/her job nature is related to major courses of the studies, he/she will be permitted for the internship at workplace provided; a declaration by an employer is submitted directly to the LSC head and School. Both, declaration by an employer and the training completion certificate will be attached along with Internship report.

- 3) Internship is of four credits with a period of 4 weeks and carries a weightage of 50-50% in 'Continuous Assessment (CA)' and 'End examination (EE)'. The internship time period does not extend beyond end examination of OJT.
 - Total Study efforts (including Self-Study) in Hours: Total 120 Hours
 - On-Job-Training/Internship (@during 22working days) in a month: minimum 110Hours
 - Preparation of Internship Report: 10 Hours
 - Duration– i) After end examination of semester 02 and before beginning of semester 03 or ii) Any one month within semester 02 of the programme
- 4) At the end of the internship, each student is required to provide a printed copy of their consolidated diary/journal and internship report for the evaluation of internship. The report must express exactly what was learned and accomplished during the internship.
- 5) The Intern will be assessed by
 - a) Continuous Assessment (CA) - Mentor of the Industry/NGO/organization/Institute Etc where student is selected for Internship
 - b) End Examination (EE) - LSC Supervisor/PC and External Examiner.

B. Monitoring and Evaluation:

Monitoring: During internship period as part of 'Continuous assessment (CA)', the mentor should evaluate the interns using the following points and should issue a recommendation letter that whether Intern/student meets the expectations of the internship or not:

1	Behaviors, Shows interest in assigned work, Willingness to learn
2	Accepts responsibility, Cooperates with co-workers and supervisors, Demonstrates organizational skills
3	Uses time, knowledge and expertise effectively, Analyzes problems effectively
4	Demonstrates creativity/ originality / any innovative contribution, Professional ethics and accountability
5	Writes effectively, Produces high quality work/Skill Proficiency

Evaluation: At internship, the intern will be evaluated in the end examination (EE), by a duly constituted expert committee of internal and external, on the following suggestive aspects:

- Professional Attitude
- Maintenance of Daily Diary
- Internship Report
- Viva voce/Oral

Reference-Link: Explore additional details!	
ZOO 513 –RL 1	UGC Internship Guidelines https://www.ugc.gov.in/pdfnews/1887287_Rsearch-Internship-Guidelines-120522.pdf
ZOO 513 –RL 2	AICTE Internship Portal https://internship.aicte-india.org/
ZOO 513 –RL 3	NITI Aayog Internship Scheme https://www.niti.gov.in/internship

COURSE OUTCOMES

After successful completion of this course, student should be able to –

- Students will demonstrate proficiency in applying theoretical knowledge and academic concepts to real-world professional situations.
- Students will possess job-specific skills that are relevant to their chosen field of study, enabling them to perform tasks and responsibilities effectively and efficiently.
- Students will acquire a comprehensive understanding of industry practices, trends, and challenges, contributing to their overall knowledge and expertise in the field.
- Students will establish professional networks and relationships, expanding their professional connections and opportunities for future collaborations and career advancement.
- Students will develop problem-solving and critical thinking abilities, demonstrating the ability to analyze complex situations, make informed decisions, and propose effective solutions.
- Students will demonstrate professionalism, adaptability, and effective communication skills in a professional work environment.

ZOO514: Field Project (FP)

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology)

COURSE INFORMATION

Sem	Other	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	FP	ZOO514	Field Project	4	12	120	50	50	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	The objectives of this course are: <ol style="list-style-type: none">To observe and interpret the subject of study in its natural environment.Field studies of animals help scientists understand the complexities and causes of animal behavior.Wild animals interact with their physical surroundings and the biological world while breeding, eating, and moving within their habitat.

DETAILS ABOUT FIELD PROJECT:

DOMAINS:

Maharashtra is a diverse state with various ecosystems, zoological challenges, and research opportunities. Choose a domain that aligns with your interests, the expertise of your faculty, and the resources available in your region. Field projects offer an opportunity to apply theoretical knowledge to real-world situations and contribute to addressing zoological challenges in the region. Some potential domains of field work for Zoology students are listed as follows. Learner may find this helpful while choosing topic of the field work, but not limited to -

- Avian Diversity and Conservation:** Study the diversity of bird species in different ecosystems within Maharashtra, focusing on their behavior, migration patterns, and conservation status.
- Freshwater Ecosystem Assessment:** Investigate the biodiversity and ecological health of freshwater ecosystems like rivers, lakes, and wetlands in Maharashtra.

- **Mammalian Behavior and Ecology:** Research the behavior, social structure, and ecological roles of mammalian species, including those in protected areas and urban environments.
- **Reptile and Amphibian Ecology:** Explore the ecology and distribution of reptile and amphibian species in Maharashtra, including habitat preferences and responses to environmental changes.
- **Insect Taxonomy and Diversity:** Conduct a comprehensive survey of insect diversity, identifying and cataloging species in specific regions of Maharashtra.
- **Marine Biodiversity:** Study the marine life along Maharashtra's coastline, including the diversity of marine species, intertidal ecosystems, and the impact of anthropogenic activities.
- **Animal Communication and Signals:** Investigate the communication methods and signaling systems used by various animal species in Maharashtra, focusing on visual, auditory, and chemical cues.
- **Endangered Species Conservation:** Focus on the conservation of endangered or threatened species found in Maharashtra, including strategies for habitat restoration and captive breeding.
- **Animal Physiology in Changing Environments:** Research how various animal species adapt to changing environmental conditions, such as temperature fluctuations and pollution, in different parts of Maharashtra.
- **Ecotoxicology:** Study the effects of pollutants and contaminants on the health and behavior of local wildlife species in various habitats in Maharashtra.
- **Urban Wildlife Ecology:** Explore the interactions between wildlife and urban environments in Maharashtra, addressing challenges and proposing strategies for coexistence.
- **Parasitology and Host-Parasite Interactions:** Investigate host-parasite relationships in local wildlife species, including the impact of parasites on host health and behavior.
- **Behavioral Ecology of Social Insects:** Focus on the behavior and ecology of social insects like ants, bees, and wasps, studying their roles in ecosystems within Maharashtra.
- **Zoo Archaeology:** Examine animal remains from archaeological sites in Maharashtra to reconstruct past environments, human-animal interactions, and cultural practices.
- **Conservation Genetics:** Apply genetic techniques to assess the genetic diversity and population structure of wildlife species in Maharashtra, informing conservation strategies.
- **Wildlife Forensics:** Investigate the use of genetic and morphological techniques in wildlife crime investigations, addressing issues like poaching and illegal trade.
- **Ecological Impact of Invasive Species:** Study the impact of invasive animal species on native ecosystems in Maharashtra and propose management solutions.

- **Marine Mammal Research:** Research the distribution, behavior, and conservation status of marine mammals along the Maharashtra coastline.
- **Animal Cognition and Intelligence:** Explore the cognitive abilities and problem-solving skills of various animal species within Maharashtra.
- **Habitat Fragmentation and Connectivity:** Investigate how habitat fragmentation affects animal populations and ecosystems in different regions of Maharashtra.

GUIDELINES: [IN PROCESS]

Topic Selection and Proposal:

- Choose a well-defined and feasible topic that aligns with your interests, available resources, and the expertise of your mentors.
- Develop a clear and comprehensive project proposal that outlines the research objectives, significance, methodology, and expected outcomes.

Research Planning:

- Define your research question and objectives precisely. Identify the scope of your study, study area within Maharashtra, and the timeline for fieldwork.
- Conduct a thorough literature review to understand the existing knowledge and identify gaps in the chosen area of study.

Methodology:

- Determine the appropriate research methods and techniques based on your research objectives. These might include field surveys, sample collection, laboratory analysis, interviews, or experiments.
- Detail the step-by-step procedures you will follow during fieldwork, ensuring they are well-structured and repeatable.

Ethics and Permissions:

- If your research involves human subjects, ensure you obtain necessary ethical approvals from your academic institution.
- If conducting research/field work in protected areas or involving sensitive species, obtain required permits or approvals from relevant authorities.

Data Collection:

- Collect data systematically and accurately according to your defined methodology. Maintain organized records of observations, samples, measurements, and any other relevant information.

Data Analysis:

- Organize and manage your collected data in a format suitable for analysis.

- Apply appropriate statistical or analytical techniques to interpret your data and draw meaningful conclusions.

Results and Interpretation:

- Present your findings using tables, graphs, charts, and descriptive text.
- Interpret your results in the context of your research question and compare them with existing literature.

Discussion and Conclusion:

- Discuss the implications of your findings, considering how they contribute to the existing knowledge in your field and address the research gaps you identified.
- Reflect on any limitations of your study and suggest potential avenues for further research.

Reporting and Documentation:

- Create a well-structured report that includes an introduction, objectives, methods, results, discussion, and conclusion sections.
- Include proper citations for references to literature.
- Visual aids such as photographs, maps, and diagrams can enhance the clarity of your report.

Presentation and Communication:

- Present your findings to your academic institution, peers, and mentors through a seminar, presentation, or poster session.
- Practice clear and concise communication to effectively convey your research process and outcomes.

Time Management:

- Plan your fieldwork, data collection, and analysis schedule to ensure efficient use of time and resources.

Mentorship and Feedback:

- Collaborate closely with mentors or advisors who can provide guidance, feedback, and support throughout the project.

Flexibility and Adaptability:

- Be prepared to adjust your plans if you encounter unexpected challenges during fieldwork or analysis.

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
-			
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO514:RB2	Biodiversity: An Introduction, -Kevin J. Gaston and John I. Spicer	3rd edition, 2018	978-1119580201, Wiley-Blackwell
ZOO514:RB3	Principles of Conservation Biology, -Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll	4th edition, 2014	978-0878935970, Sinauer Associate
ZOO514:RB4	Sustaining Life: How Human Health Depends on Biodiversity, -Eric Chivian and Aaron Bernstein	1st edition, 2008	978-0195175097, Oxford University Press
ZOO514:RB5	Conservation Biology: Foundations, Concepts, Applications, -Fred Van Dyke	2nd edition, 2008	978-1405107375, Springer
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO514:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO514:WL1	https://sdgs.un.org/goals		
ZOO514:WL2	https://cpcb.nic.in/standards/		
ZOO514:WL3	www.ipcc.org ; https://www.ipcc.ch/report/sixth-assessment-report-cycle/		
OER: Explore additional details and reinforce learning, with this optional learning resource!			

COURSE OUTCOMES

After successful completion of this course, student should be able to –

- Demonstrate the ability to apply theoretical knowledge and concepts to real-world situations, effectively bridging the gap between academia and practical applications.
- Develop advanced research and investigative skills, including the ability to design and execute research projects, collect and analyze data, and draw well-founded conclusions.
- Conduct independent research, demonstrating the ability to formulate research questions, design appropriate methodologies, and independently execute fieldwork or data collection.
- Exhibit effective collaboration and communication skills, demonstrating the ability to work collaboratively with others, engage in professional dialogue, and effectively communicate their research findings to diverse audiences.
- Showcase advanced problem-solving and critical thinking abilities, demonstrating the capacity to identify and address challenges encountered during fieldwork, analyze complex data, and propose innovative solutions.
- Demonstrate a thorough understanding of ethical considerations, field safety protocols, and best practices in their chosen field of study.

Elective Courses

ZOO515: Animal Biotechnology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	DSE	ZOO515	Animal Biotechnology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B. Sc with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> To create awareness on advanced streams like Stem Cell Biology, Animal Cell Culture, Genomics and Proteomics, Drug Design, Genetic Engineering and Bioinformatics. To provide hands on experience related to Animal Cell Culture, Molecular Techniques, Drug Design and Instruments handling.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Introduction to biotechnology Mammalian reproductive system And IVF Cryopreservation Advancement of Biotechnology	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Cell culture Mammalian cell lines & their characteristics Tissue culture system Cloning:	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks
03-01 03-02 03-03 03-04	Transgenic animal-I: Transgenic animal-II: Genetic Engineered Animal Cell Culture Recombinant Microorganisms	CR 03 MLs 41-60	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks
04-01 04-02 04-03 04-04	Medical biotechnology Medical biotechnology Insecticide development Biotechnology of aquaculture	CR 04 MLs 61-80	(LAQ may contain sub-questions (a), (b) and so on.)

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Introduction To Biotechnology: Introduction to biotechnology- scope, importance and its applications.	CR 01
1-2	Mammalian Reproductive System And IVF: Mammalian reproductive systems and Gametogenesis. In vitro fertilization and embryo transfer; ICSI, sperm sexing.	
1-3	Cryopreservation: Cryopreservation, cry protection and gamete banking	
1-4	Advancement of Biotechnology: IVF technique	
2-1	Cell culture: Equipment and materials for cell culture technology, principle of sterile techniques and cell propagation, primary and established cell line cultures	CR 02
2-2	Mammalian Cell Lines & Their Characteristics: Mammalian cell lines & their characteristics. Basic techniques of mammalian cell culture in vitro, disaggregating of tissue and primary culture, maintenance of cell culture, cell separation.	
2-3	Tissue Culture System: Tissue culture system – cell tissue fragment, organ and embryo cultures, merits and demerits	
2-4	Cloning: Scaling-up of animal cell culture, cell synchronization, cell cloning, Micromanipulation, cell transformation.	
3-1	Transgenic animal-I: Transgenic animals; creation of transgenic mice, retroviral vector method, Microinjection, embryonic stem cell method – short gun, electroporation, lipofection, microinjection.	CR 03
3-2	Transgenic animal-II: Production of other transgenic animals – cattle, sheep, pigs and fish	
3-3	Genetic Engineered Animal Cell Culture: Large scale culture and production from genetically engineered animal cell culture.	
3-4	Recombinant Microorganisms: Large scale culture and production from recombinant microorganisms –Downstream processing	
4-1	Medical biotechnology: Application of RFLP in forensic science, hybridoma technology and production monoclonal antibodies	
4-2	Environmental Biotechnology: Bioassay, biosensors in eco-toxicological screening; Bioleaching of metals by microorganisms; Bio-absorption of metals by bacteria.	
4-3	Insecticide development: Bio-pesticides; Bacillus thuringiensis – mode of action of toxin, toxin gene isolation and engineering of B. thuringiensis.	
4-4	Biotechnology of aquaculture: Sex reversal in fish and sterile fish culture, Use of animals as bioreactors; Knock out model systems and their utility.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO515	Animal Biotechnology,	2022	978-93-95855-63-1

	- Dr. A. P. Bhagat		YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO515- RB1	Principles of Gene Manipulation and Genomics, Primrose, -S. B. and Twyman, R. M., (7 th Ed.)	2006	9788126548392 Blackwell Publishing, West Sussex, UK
ZOO515- RB2	Recombinant DNA: Genes and Genomics – a short course, -Watson et al.	1991	W. H. Freeman and Company, New York, USA
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO515 - CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO515- WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Understand and appreciate major public concerns and issues associated with Animal Biotechnology.
2. Have an understanding and grasp of international research environment where the frontiers of knowledge in Animal Biotechnology are under research.
3. Be able to adapt and respond positively and flexibly to changing circumstances;
4. Develop the professional skills and personal attributes to deal with complex issues, both systematically and creatively.
5. Have the capacity for individual work and teamwork.
6. Be lifelong learners with intellectual and practical skills.

ZOO516: Toxicology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	DSE	ZOO516	Toxicology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> The goal of toxicology is to contribute to the general knowledge of the harmful actions of chemical substances, To study their mechanisms of action, and to estimate their possible risks to humans on the basis of experimental work on biological test systems.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Importance Of Toxicology Dose Effect And Dose Response Relationship Factors Affecting Toxicity Absorption And Distribution Of Toxicants	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Mechanism And Reactions Of Toxicants Lipid Peroxidation Oxidative Stress Antioxidant Defense Mechanism	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks
03-01 03-02 03-03 03-04	Basics Of Organ Toxicity Hepatotoxicity Pulmonary Toxicity Renal Toxicity And Neurotoxicity	CR 03 MLs 41-60	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks
04-01 04-02 04-03 04-04	Eco-Toxicology Of Heavy Metals Environmental Problems Occupational Hazards Carcinogenesis	CR 04 MLs 61-80	(LAQ may contain sub-questions (a), (b) and so on.)

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Importance of toxicology: Definition, scope and importance of toxicology; classification of toxic agents – natural toxins, animal toxins, plant toxins, food toxins, genetic poisons and chemical toxins.	CR 01

1-2	Dose effect and dose response relationship: Dose, dose effect and dose response relationship –Acute toxicity, chronic toxicity; toxic kinetics.	
1-3	Factors Affecting Toxicity	
1-4	Absorption and distribution of toxicants: Absorption and distribution of toxicants, portals of entry – Skin, gastrointestinal tract and respiratory system. Bio-accumulation, bio-magnification, bio-transformation and elimination of xenobiotics	
2-1	Mechanism and reactions of toxicants - Covalent bonding, non-covalent bonding and enzymatic reactions.	CR 02
2-2	Lipid Peroxidation	
2-3	Oxidative Stress	
2-4	Antioxidant Defense Mechanism- Covalent bonding, non-covalent bonding and enzymatic reactions. Xenobiotic induced intracellular and cellular alterations	
3-1	Basics of organ toxicity - Target organs, organ selectivity and specificity	CR 03
3-2	Hepatotoxicity - susceptibility of the liver; Types of liver injury and biochemical mechanism.	
3-3	Pulmonary toxicity – Lung injury, systematic lung toxins, lung pathology.	
3-4	Renal toxicity and Neuro toxicity: Renal toxicity– susceptibility of the kidney to toxicants; Chemical induced renal injury. Neuro toxicity – Effect of toxic agents on neurons, ion channel neurotoxins; Lesions of neural tissue	
4-1	Eco-toxicology of heavy metals – Mechanism of heavy metal toxicity; Case studies of Arsenic, Mercury and Cadmium.	CR 04
4-2	Environmental problems: Environmental problems by Organochlorine and organophosphate pesticides; case studies of DDT, Endosalphan, parathion and malathion.	
4-3	Occupational hazards - physical, chemical, biological and mechanical hazards. Occupational diseases: Pneumoconiosis, silicosis, asbestosis; Prevention of occupational Diseases.	
4-4	Carcinogenesis – Carcinogen types, mechanisms of carcinogenesis; Skin cancer, lung cancer and leukemia	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO516	Toxicology, – Miss. P. A. Dhage	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			

ZOO516- RB1	Environmental Biology and Toxicology, -P.D. Sharma	1998	Rastogi Publications, Meerut (India),
ZOO516- RB2	Toxicology and Risk Assessment: A Comprehensive Introduction, -Greim H., and Snyder, R. (ed)	2003	08031 1998 4 John Wiley and Sons, UK
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO516 - CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO516- WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Students will demonstrate an understanding of the core concepts of the science of toxicology, including hazard identification, exposure assessment, dose-response assessment and an understanding of the mechanisms of action and effects of toxic chemicals at multiple levels of biological organization.
2. Students will demonstrate an understanding of the role for the science of toxicology in society, including the importance of risk analysis, management and communication. Students will be able to identify and discuss contemporary issues in toxicology.
3. Students will be familiar with technical aspects and experimental approaches in toxicological research, testing and risk assessment.

SEMESTER 03

ZOO601: Immunology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem.	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSC	ZOO601	Immunology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: <ol style="list-style-type: none">To develop basic understanding about Immunity, its organization and their mechanisms.To understand in detail the basic immune mechanism related to different Immunological diseases & disorders.To create and develop the ideology about different vaccines, immune treatment mechanisms, cancer immunotherapy and latest experimental immune system.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Introduction to Immune System The Lymphoid System Cells Involve in Immune Response Structure and Function of Immunoglobulin	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Major Histocompatibility Complex in Mouse and Humans The Humeral Immunity Cell Mediated Immunity The Complement System	CR 02 MLs 21-40	<ul style="list-style-type: none">Very Short Answer Question (VSAQ), of 03 marksShort Answer Question (SAQ), of 05 marks
03-01 03-02 03-03 03-04	Hypersensitivity Autoimmunity and Immune Diseases Immunity to Infectious diseases Immunity to Parasitic Diseases	CR 03 MLs 41-60	<ul style="list-style-type: none">Long Answer Question (LAQ) of 10 Marks

04-01	Vaccine	CR 04 MLs 61-80	(LAQ may contain sub-questions (a), (b) and so on.)
04-02	Transplantation and Organ Rejection		
04-03	Tumor Immunology		
04-04	Immunodiagnostic and Applications		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Introduction to Immune System: History of Immunology, Innate and Acquired immunology, Antigens Haptens and carriers.	CR 01
1-2	The Lymphoid System: Primary Lymphoid organs, Secondary Lymphoid organs, Clonal Selection theory, Lymphocyte traffic.	
1-3	Cells Involve in Immune Response: Origin of cell involved in Immune Response, Cells of the Immune System- Lymphocytes, Cells of the Immune System- Phagocytes Granulocytes and Dendrite cells, Cell involve in antigen processing and presentation.	
1-4	Structure and Function of Immunoglobulin: Basic structure of Immunoglobulin, Immunoglobulin classes and their functions, Immunoglobulin genes and their diversity.	
2-1	Major Histocompatibility Complex in Mouse and Humans: Organization of MHC, MHC Molecule- Class-I and Class II Molecule, Pathway for Antigen presentation, Self MHC restriction of T cells, MHC and disease susceptibility.	CR 02
2-2	The Humeral Immunity: Kinetics of Humeral Immune response, Immunological Memory, Antibody Production, Regulation of Immune Response.	
2-3	Cell Mediated Immunity: Overview of cell mediated Immunity, Cells involve in cell mediated Immune Response, Function of cell mediated Immunity, Role of cytokines.	
2-4	The Complement System: Components of the complement, The Complement Pathways, Complement deficiencies.	
3-1	Hypersensitivity: Classification of hypersensitivity reaction, Type I Hypersensitivity reaction, Type II Hypersensitivity reaction, Type III Hypersensitivity reaction, Type IV Hypersensitivity reaction, Inflammation.	CR 03
3-2	Autoimmunity and Immune Diseases: Organ Specific Autoimmune diseases, Systemic Autoimmune diseases, T-cell deficiency diseases, B-cell deficiency diseases, Secondary Immunodeficiency.	
3-3	Immunity to Infectious diseases: Viruses, Bacteria.	
3-4	Immunity to Parasitic Diseases: Immunity response to Protozoan Parasites, Immune Response to Helminthes.	
4-1	Vaccine: History, Immunity - immunization, Classification of Vaccines.	CR 04
4-2	Transplantation and Organ Rejection: Transplantation antigens, Transplantation Immunity, Immune Mechanism of Graft Rejection, GvHr, Immune tolerance and immunosuppressive agents.	

4-3	Tumor Immunology: Tumor antigens, Immune response to tumors, Immune surveillance, Immunodiagnostic and Immunotherapy.	
4-4	Immunodiagnostic and Applications: Antigen antibody interaction, Precipitation and agglutination reaction, RIA and ELISA and Immunofluorescence, Hybridoma Technology and monoclonal Antibodies.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO601	Immunology, - Dr. A. R. Kurhe	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO601:RB1	Immunology, -David, Brostoff and Roitt, (7th Ed.)	2006	978-0749256579 Mosby & Elsevier Publishing, Canada, USA.
ZOO601:RB2	Immuno Biology- The immune system in health and disease, -Janeway, Travers, Walport and Shlomchik, (6 th Ed.)	2005	Garland Science Publishing, New York, USA.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO601:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO601:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Understanding about Immune System & its mechanisms.
2. Explain Ag-antibody reaction.
3. Various techniques used in Immunology.

ZOO602: Endocrinology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSC	ZOO602	Endocrinology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> BSc with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> The course focuses on helping the students to understand the basics of endocrinology and impart knowledge about the endocrine regulation of different body functions. Besides, it aims to understand the integrative working of signaling system in maintaining homeostasis.

UNITS

UN	Name of the Unit	CSs	Questions
01-01 01-02 01-03 01-04	Scope Of Endocrinology Endocrine System Hormone Mechanism Homeostasis	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Invertebrate endocrinology-I Invertebrate endocrinology-II Vertebrate endocrine- I Vertebrate endocrine- II	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks
03-01 03-02 03-03 03-04	Hormones Steroid hormone Transport Hormone Transport-I Hormone Transport- II	CR 03 MLs 41-60	<ul style="list-style-type: none"> Long Answer Question (LAQ) of

04-01	Obesity	CR 04 MLs 61-80	10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
04-02	IVF Techniques And Hormone mechanism		
04-03	Pheromone		
04-04	Hormone in Insects		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Scope Of Endocrinology: Scope and position of endocrinology role in health disease, Concept of neuro-hormones and neurotransmitters.	CR 01
1-2	Endocrine System: Characteristics of neural and hormonal integration, neuro-endocrine mechanism.	
1-3	Hormone Mechanism: Hormones as chemical messengers; Regulation of hormone secretions – negative and positive and feedback mechanisms.	
1-4	Homeostasis: Concept of internal environment and homeostasis- regulatory mechanisms.	
2-1	Invertebrate endocrinology-I: Invertebrate endocrine system – Hormones and their functions Coelenterata and Annelida.	CR 02
2-2	Invertebrate endocrinology-II: Invertebrate endocrine system – Hormones and their functions Arthropoda and Echinodermata.	
2-3	Vertebrate endocrine- I: Hypothalamus and its secretions, Vertebrate endocrine glands – Structure, hormones and functions of pituitary, thyroid, parathyroid and thymus.	
2-4	Vertebrate endocrine- II: Vertebrate endocrine glands – Structure, hormones and functions of adrenal, pancreas, pineal, gastro-intestinal tract and gonads.	
3-1	Hormones: Classification of hormones,	CR 03
3-2	Steroid hormone Transport: Biosynthesis of release and transport of amino acid derivatives.	
3-3	Hormone Transport-I: Biosynthesis and transport of peptide and steroid hormones. Membrane bound and intra cellular receptors	
3-4	Hormone Transport- II: Mechanism of action of amino acid derivatives, peptide and steroid hormones.	
4-1	Obesity – Role of hormones and its metabolic complications – The role of Adipokines Insulin Resistance and Dyslipidemia.	CR 04
4-2	IVF Techniques And Hormone mechanism: Hormones in IVF, pregnancy testing, and Amniocentesis, Clinical disorders of male and female gonads.	
4-3	Pheromone: Pheromones in applied endocrinology; Induced breeding in fish.	
4-4	Hormone in Insects: Hormones in Sericulture and Apiculture.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO602	Endocrinology - Dr. R. B. Andhale		

Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!

ZOO602:RB1	Comparative Vertebrate Endocrinology -Bentley, P. J.	2021	978-1-83880-396-4 Cambridge University Press, UK
ZOO602:RB2	General and Comparative Endocrinology -E.J.W. Barrington	1975	Oxford Clarendon Press

CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!

ZOO602:CD1			
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Web Links: Explore additional details and reinforce learning, with this optional learning resource!

ZOO602:WL1			
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COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. To develop an understanding of the basic endocrinology.
2. To study the endocrine regulatory molecules mediating physiology and behavior.
3. To study the neural and endocrine components of physiological function and neuroendocrine regulation.
4. To understand the role of hormones in metabolic regulation and maintaining homeostasis.
5. To understand the integrative working of signaling system.

ZOO603: Biodiversity & Conservation

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSC	ZOO603	Biodiversity & Conservation	2	6	60	15	35	50	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	Objectives of this course are: <ol style="list-style-type: none"> To preserve the diversity of species. Sustainable utilization of species and ecosystem. To maintain life-supporting systems and essential ecological processes.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Introduction To Biodiversity	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
01-02	Biogeography Regions Of India		
01-03	Biodiversity And Ecosystem Function		
01-04	Importance Of Conservation		
02-01	Causes For Depletion Of Wildlife	CR 02 MLs 21-40	
02-02	Special Conservation Projects In India		
02-03	Climate And Climate Change		
02-04	Environmental Stress		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Introduction to Biodiversity: Concepts, components, process and patterns Conceptual frame work of Biodiversity. Patterns and process of local and regional biodiversity Niche assembly theories unified Neutral theory, and Island biogeography model.	CR 01
1-2	Biogeography regions of India: Distribution of wildlife: Global scenario, Indian scenario Himalayan ranges, Western Ghats, Andaman and Nicobar Islands. Wildlife habitats and their protection.	
1-3	Biodiversity and Ecosystem function: Theories on relation between biodiversity and ecosystem function, Species Complementarity, Sampling effect, Redundancy. Decline of global biodiversity and loss of ecosystem function. The	

	economics of biodiversity and ecosystem function.	
1-4	Importance of conservation: In response to expanding anthropogenic demands, In response to global climate changes, Multidimensional aspects of conservation biology, Bio-geographic classification. Wildlife conservation and management General importance; History of wildlife management and current status; protected area network in India.	
2-1	Causes for depletion of wildlife: with special reference to India. Study of Threatened, Endangered, Endemic, Extinct fauna of India vertebrate - Invertebrates	CR 02
2-2	Special conservation projects in India -Project Tiger, Project Gir Lion, Project hangul, musk deer project, Manipur Deer project, Project Elephant, Crocodile Breeding Project, Great Indian Bustard project.	
2-3	Climate and Climate Change: Concept and current status of climatic change, Nature of Climate Change Observed and Projected Changes in Climate, Climate Change Policy of India.	
2-4	Environmental Stress: Environmental Stresses and their management, global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition, coping with climatic Variations	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO603	Biodiversity & Conservation, - Dr. Anil Kurhe	2022	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO603:RB1	Fundamental of Ecology, -SK Agarwal	2001	978-9350781678 Ashis Publication House, New Delhi.
ZOO603:RB2	Ecology and Environment, - P.D. Sharma	1994	8171339654 Rastogi Publications
ZOO603:RB3	Ecological Diversity, - Magurraan, A	1983	9780691084916 University press Cambridge
CD / DVD: Explore additional details and reinforce learning with this optional learning resource!			
ZOO603:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO603:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Healthy and diverse ecosystems.
2. Viable populations of species.
3. Genetic resources and adaptive potential.
4. Sustainable use of biological resources.
5. Species' roles in an ecosystem.

ZOO604: Lab on Immunology, Endocrinology And Biodiversity & Conservation

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSC	ZOO604	Lab on Immunology, Endocrinology and Biodiversity & Conservation	4	24	120	25	25	50	P

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B Sc with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are::</p> <ol style="list-style-type: none"> To study the immune system and its role in protecting the body from infection and disease evaluation and management of disorders of the body's glands, hormonal secretions, and resultant changes in body metabolic activity Biodiversity conservation has three main objectives: To preserve the diversity of species. Sustainable utilization of species and ecosystem

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
Immunology		
1-1	To study and determination of Agglutination test	CR 01
1-2	To study and describe the precipitation reaction	
1-3	To study and Demonstration of Immuno-electrophoresis	
1-4	To study of Neutralization and complement fixation	
1-5	To study of Separation of lymphocytes	
2-1	Preparation and study of phagocytosis by splenic/peritoneal macrophages	CR 02
2-2	Immunization schedules and rising of antibodies	
2-3	Identification of histological slides of lymphoid tissue - Spleen, thymus, lymphnode and bone marrow	
2-4	To study and Demonstration of lymphocyte transformation test with nitrogen and an antigen	

Endocrinology		
2-5	To study Histology slides of Endocrine glands - Pituitary, Thyroid, Parathyroid, Thymus, Adrenal, Pancreas, Ovary & Testis, and Uterus	
3-1	To study of effect of Eye Stalk ablation on Blood Glucose levels in Crabs	CR 03
3-2	Identification of Gonadotrophin in Human urine samples	
3-3	To Study the effect of parathormone on serum calcium levels in Rat	
	To study the effect of insulin and adrenalin on blood glucose levels in Rat	
3-4	To study the effect of thyroxin and thiourea (antithyroid agent) on oxygen consumption in fish	
3-5	To study of effect of Eye Stalk ablation on Blood Glucose levels in Crabs	
Biodiversity & Conservation		
4-1	Water Analysis: Estimation of total hardness, salinity, chloride, calcium, magnesium, phosphate	CR 04
4-2	Estimation of Primary productivity of water bodies.	
4-3	Study of the traditional knowledge of biodiversity conservation of any local communities	
4-4	Study of bacterial succession in Milk	
4-5	Identification of Limnological Apparatus: Secci Disk, Jacksons Candle Turbidometer, Ekmanns Dredger. Comment on animal association/interaction: Commensalism, parasitism, mutualism, predation, proto cooperation	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO604	Lab on Immunology, Endocrinology And Biodiversity & Conservation, – Dr. A. R. Kurhe, Dr. R. B. Andhale, Mr. Amol Pund & Mr. Sachin Jangam	2022 & 2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO604:CD 1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO604:WL 1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Preservation of the diversity of species.
2. Sustainability of species and ecosystem.
3. Maintaining life-supporting and essential ecological processes.

ZOO605: RESEARCH PROJECT - I

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Other	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	RP	ZOO605	Research Project-I	4	12	120	50	50	100	PW

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	The objectives of this course are: <ol style="list-style-type: none">To develop technical skill.To empower our students with practical skills.To comprehend the physiology and other functions of each and every vital systems.

GUIDELINES:

No	Guidelines for the Students and Study Centers for the conduct of Project
1	The "Project Work" course aims to imbibe in students the principle that working is learning. Learning and working are two sides of the same coin and thus, work experience enhances the learning.
2	This course is based on preliminary research oriented topics both in theory and experiment. The subject expert/ counselor will act as supervisors for the projects. Project shall be on the current and relevant topics and issues. Project topic is jointly finalized by the student and the project supervisors through discussion. At the completion of the project by the semester end, the student will submit a Project Report in the form of Dissertation which will be examined by the examiners. The end examination shall consist of (a) Presentation and (b) Comprehensive viva-voce.
3	Students are expected to work on "Project Work" for about 6 hours per week (About 2 hour's self-study at residence and 12 hours in counseling session at study centre), during a semester. Thus only those projects, demanding such study efforts on all those activities, listed in above, should be selected.
4	A single student will have to do a project. Since. The student invests his energy, time and resources in a project. The project therefore should, have important focus on some relevant practical aspects. This will help student to justify his efforts on project.

5	Employed Students are allowed to complete “Project Work” in the industry where he/ she is employed or his/ her place of choice. Such a student has to identify a resource person in industry, who can take responsibility of guiding him in project work. Such person should be eligible to work as “Project Guide”.
6	Study centre should assist unemployed students, in locating sponsored “Projects” from local industries. Students are encouraged to locate sponsored projects from the local industries. But, in case, a student is unable to locate such project, he is also allowed to complete “Project Work” at his study center.
7	The Project Work must involve practical research work related to your selected discipline.
8	Students have to finance expenditure on “Project” by his own. Hence students should select those projects, accordingly.
9	Each “Project Guide” may be assigned maximum 5 students.
10	The original design requirements are not essential , although highly encouraged. Hence, normally, projects should not be repeated. The same project undertaken in recent past, by past students, should be avoided. But it is most important that, students must put his independent study efforts on the project. Thus, student should gain practical project execution knowledge about making some useful product, after he goes through all projects completion steps listed above.
11	<p>There project report should be file bound/spiral bound/hard bound and should have following format</p> <p>Title Page/Cover page Certificate endorsed by Project Guide/Supervisor, Learner Support Center Coordinator and Head Declaration for followed ethical practice and non-plagiarism Acknowledgement Abstract of the project Table of Contents List of Figures List of Tables Chapters of Project Report –</p> <p>Chapter 1: Introduction: Background of the project, Need for the project, Brief idea of the project, Literature review, Aims and Objectives of the project</p> <p>Chapter 2: Design and Methodology: overview of the complete project, the scientific principles involved in the design of the project, Block Diagrams, Experimental/Theoretical Methodology/Circuit/Model/ materials required, etc.</p> <p>Chapter 3: Testing, Conduct of Experiment/ Module: Actual conduct of experiment, measurements, observations, etc.</p> <p>Chapter 4: Analysis of Data: Analysis of the data and observations received during experimentation</p> <p>Chapter 5: Results, Discussion and Conclusions: Discuss why the specifications were not met or the reasons for the failure, if any. Discussed the problems and difficulties encountered and how they were / can be eliminated. Discuss any extension work or modifications, which you want to suggest.</p> <p>Chapter 6: References: List the books, reference books, journals, websites, magazines and data manuals used, etc.</p>
12	Project Report Submission Process: Student should prepare 2 copies of the Project Report. At the beginning, the respective Project Guide must approve both copies positively before the end examination of Project Work. Then respective Study

	<p>Center Coordinator approves both copies of the Project Report. Student should submit one of these approved copies to the study center. The student should retain remaining one of these approved copies. Study center should preserve their copy of, all project reports, till the end examination of Project Work. Even student must bring his own copy during this end examination.</p>
13	<p>Project Report Format:</p> <ol style="list-style-type: none"> 1. The project report should be printed on only right side of A4 size (210 mm ´ 297 mm) paper. There is no minimum or maximum page number limit for the “Project Report”, but report of minimum 50–70 pages is expected. University recommends only flexible binding for the “Project Report”. But, if student wishes, he may also use spiral binding. 2. Margins should be as follows: <ul style="list-style-type: none"> • Left Margin : 40mm • Right Margin : 20mm • Top Margin : 20mm • Bottom Margin : 27mm 3. Header should not be used. Footer, containing page number at the center should only be used, with footer margin of 25mm. 4. Text should be printed in font size of 12 points and at interline distance of 18 points. (That is 1.5 line spacing). Normally, figures should be embedded in the text, where there first reference occurs. But if necessary, figures may be grouped on separate pages. Figure should be numbered as ‘Fig C.F’, where ‘C’ is chapter number and ‘F’ is figure number. Figure number ‘F’ is reset back to 1 for each new chapter. <p>Page Sequence: (1) Cover page as per specimen 1 (2) Certificate page as per specimen 2 (3) Acknowledgement page for the help offered by individuals and institution (4) Content page as per specimen 3. Following suggested scheme of chapters in project report then follows these first 4pages.</p>
14	<p>Specimen of Pages</p>

<p>Specimen 1</p> <p>Project Title- M.Sc. in Submitted by Name of Student- Name of Project Guide- Name of the Learner Support Center-</p> <p>Yashwantrao Chavan Maharashtra Open University 20... - ...</p>	<p>Specimen 2 Certificate</p> <p>This is to certify that</p> <p>Mr/Ms.....</p> <p>.....(PRN ...)</p> <p>Has successfully completed a project entitled "."</p> <p>in partial fulfillment for the requirement of</p> <p>Master of Science in</p>				
	Signature with Date				
	<table border="1"> <tr> <td>Project Guide</td> <td>LSC Coordinator</td> </tr> <tr> <td>Internal Examiner</td> <td>External Examiner</td> </tr> </table>	Project Guide	LSC Coordinator	Internal Examiner	External Examiner
Project Guide	LSC Coordinator				
Internal Examiner	External Examiner				

Course Outcomes

After successful completion of this course, student should be able to –

- Demonstrating a high level of research competence, having successfully planned and executed a master's-level research project.
- Honed their critical thinking abilities, demonstrated by the comprehensive literature review and critical analysis of research findings.
- Proficient in selecting appropriate research design and methodologies, ensuring the research is well-structured and methodologically sound.
- Demonstrating expertise in collecting and analyzing data, utilizing appropriate statistical or qualitative analysis techniques.
- Developing effective project management skills, successfully meeting research milestones and completing the project within the given timeframe.
- Problem-solving abilities, adapting their research strategies to overcome challenges encountered during the research process.

Elective Courses

ZOO606: Reproductive Physiology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSE	ZOO606	Reproductive Physiology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: : <ol style="list-style-type: none">Describe the anatomy of the male and female reproductive systems, including their accessory structures.Explain the role of hypothalamic and pituitary hormones in male and female reproductive function.Trace the path of a sperm cell from its initial production through fertilization of an oocyte.

UNITS

UN	Name of the Unit {Updated as per SLM Book on 24 Feb 2024}	CSs	Questions
01-01	Male Reproductive System I	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer <ul style="list-style-type: none">Very Short Answer Question (VSAQ), of 03 marksShort Answer Question (SAQ), of 05 marksLong Answer Question (LAQ) of
01-02	Male Reproductive System II		
01-03	Male accessory ducts and accessory Reproductive organs I:		
01-04	Male accessory ducts and accessory Reproductive organs II		
02-01	Female Reproductive System	CR 02 MLs 21-40	
02-02	Histological Structure and Functions		
02-03	Gametogenesis		
02-04	Process of Ovulation, Estrous and Menstrual Cycle and Its Hormonal Regulation, Puberty and Menopause		

03-01	Fertilization, Conception, Blastocyst Formation, Implantation	CR 03 MLs 41-60	10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
03-02	Placentation		
03-03	Parturition		
03-04	Lactation		
04-01	Hormonal Regulation	CR 04 MLs 61-80	
04-02	Environmental Factors and Breeding		
04-03	Artificial Control of Reproduction		
04-04	Reproductive Dysfunctions		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit {Updated as per SLM Book on 24 Feb 2024}	CR
1-1	Male Reproductive System I : Internal and External Genitalia	CR 01
1-2	Male Reproductive System II : Histological structure and functions of testis	
1-3	Male accessory ducts and accessory reproductive organs I :- Epididymis, Seminal vesicle, Prostate gland, Bulb urethral gland	
1-4	Male accessory ducts and accessory reproductive organs II : Cryptorchidism, Semen.	
2-1	Female reproductive System : Internal and External Genitalia	CR 02
2-2	Histological structure and functions :- ovary ,Graafian follicle corpus luteum and corpus Albicans, Fallopian tube ,Uterus, Bartholin's gland, Mammary glands.	
2-3	Gametogenesis : Introduction, definition, general process of gametogenesis	
2-4	Process of Ovulation, Estrous and Menstrual Cycle and Its Hormonal Regulation, Puberty and Menopause	
3-1	Fertilization, Conception, Blastocyst Formation, Implantation	CR 03
3-2	Placentation : Formation, Types and Menstrual cycle & Its Hormonal	
3-3	Parturition : Birth Process, Ferguson Reflex	
3-4	Lactation : Anatomy and growth of Mammary gland, Lactogenesis & Galactopoiesis, Hormonal Regulation & Suckling Reflex	
4-1	Hormonal Regulation : Testicular and Ovarian Hormones	CR 04
4-2	Environmental Factors and Breeding : Continuous and Seasonal Breeders	
4-3	Artificial Control of Reproduction : Artificial Insemination , In Vitro Fertilisation, Embryo Transfer, Induced Breeding, Physical, Physiological, Surgical, Chemical Methods of Contraception in Male, Female	
4-4	Reproductive Dysfunctions : Ageing and Reproduction, Climacteric, Anatomical, Endocrine and Genetic Disorder	

LEARNING RESOURCE DETAILS

LR Code	Title	Edition	ISBN
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	Author	Year	Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO6o6	Reproductive Physiology, – Dr. Vikram Kakulte	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO6o6:RB1	Mammalian Reproduction, - P. Gibian and E.J. Platz	1970	0387050663 Springer Verlag
ZOO6o6:RB2	Biology of Reproduction, - P. J. Hogarth	1978	978-0216905672 Wiley, New York.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO6o6:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO6o6:WL1			
Course Outcomes			
After successful completion of this course, student should be able to: Knowledge of the reproductive system and its functions in animals and man. To provide a comprehensive, up-to-date review of reproductive physiology.			

ZOO607: Vermiculture

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSE	ZOO607	Vermiculture	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Compost organic wastes not for the disposal of solid organic wastes but also. To produce superior quality manure. To feed our “nutrient/organic matter hungry” soils.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Earthworm Taxonomy	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
01-02	Types Of Earthworm		
01-03	Evaluation Of Nutritional Status		
01-04	Role Of Earthworms In Soil Fertility		
02-01	Earthworms And Microorganisms	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks
02-02	Importance Of Microorganisms		
02-03	Field Sampling		
02-04	Earthworms As Animal Feed		
03-01	Earthworm Bio-Technology	CR 03 MLs 41-60	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks
03-02	Vermicomposting Technology		
03-03	Culture Techniques		
03-04	Methods Of Vermicomposting		
04-01	Production Of Vermi-Compost	CR 04 MLs 61-80	(LAQ may contain sub-questions (a), (b) and so on.)
04-02	Factors Affecting On Vermicomposting		
04-03	Role Of Earthworms In Soil Fertility		
04-04	Vermiculture And Organic Farming		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Earthworm taxonomy: General characters of Annelida, Diversity of	CR

	earthworms, Classification of Earthworm-Morphological and anatomical, habitat of earthworm (soil), Earthworm as farmer's friend.	01
1-2	Types of earthworm: Exotic and native species –used in Vermicomposting, Food habits, Digestive system, Excretion, Reproduction and Life cycle. Role of earthworms in waste management: solid wastes an option for resource recovery, expert system for hotel waste management,	
1-3	Evaluation of nutritional status: Growth response of some tree species to its application in a nursery, Earthworms as bioreactors, organic farming, influence of chemical inputs on earthworm activity, earthworms in bio-remediation.	
1-4	Role of Earthworms in soil fertility: Use of Vermi-compost, Use of earthworms in land improvement and land reclamation – Economics of Vermi-compost and vermiwash production, Earthworm as farmer's friend, economic importance of earthworms.	
2-1	Earthworms and microorganisms: Influence of chemical inputs on earthworm activities, The effects of earthworms on biomass and activity of microorganisms.	CR 02
2-2	Importance of microorganisms: As food, Dispersal of microorganisms by earthworms, Role of intestinal microbes of earthworms on decomposition of organic wastes.	
2-3	Field sampling – Passive methods, counting of mass and biomass estimation.	
2-4	Earthworms as animal feed: Medicinal value of earthworm meal – Role of Earthworms in Solid Waste, Sewage waste management and Vermifilters, Earthworms as bioreactors.	
3-1	Earthworm Bio-technology: Fundamentals of sustainability; Enrichment of Vermi-compost and earthworms for sustainable production, earthworms in alternative medicine, earthworm meal production transgenic earthworms.	
3-2	Vermicomposting technology: Introduction, Definition, history, Vermiculture techniques, advantages of Vermiculture, Methods of collection of and preservation of earthworms.	CR 03
3-3	Culture techniques: Monoculture and Polyculture, vermiwash production techniques, Requirements - types of vermicomposting materials – general procedures in home – maintenance of Vermicomposting	
3-4	Methods of Vermicomposting: Heap method – Pot method and Tray method Vermiculture for waste reduction.	
4-1	Production of Vermi-compost: Large scale manufacture, packaging of vermi-compost, marketing of Vermi-compost, worm casts.	
4-2	Factors affecting on vermicomposting: pH, moisture, temperature etc. Vermitechnology and waste management, role of earthworms on ecology, an eco-friendly approach to sustainable agriculture.	CR 04
4-3	Role of earthworms in soil fertility: Use of vermi-compost for crop production, use of vermi-compost in land improvement and reclamation,	

	potentiality of vermi-biotechnology in India	
4-4	Vermiculture and organic farming: Role of vermi-compost in organic farming, Eco-friendly farming system technology's, Evaluation study of ecological constraints (climatic, edaphic,), appropriate technologies (ranching, farmers perception to organic farming, any case study).	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO607	Vermiculture, – Dr. V. R. Kakulte		YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO607:RB1	Vermitechnology, - Christy, M. V.	1 st edition 2008	9788180940651 MJP Publishers
ZOO607:RB2	Vermitechnology, - Lekshmy, M. S., Santhi R.	2012	9789382459323 Sara Publications, New Delhi, India
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO607:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO607:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. The course is structured at the basic level for the benefit of the students coming from different discipline having broad scope for employability.
2. In general soil earthworms, their characteristic features, occurrence, their influence on soil fertility and solid waste management are included.
3. Vermicomposting technology broadly followed at the global level and some Indigenous methods, role of microbes in increasing the soil fertility by the action of earthworms, their advantages and limitations dealt.
4. Role of microbes in worms and in decomposition is discussed.
5. Vermiculture products and their benefits in agriculture practice, economics of Vermitechnology along with the practical difficulties are included.
6. Students will be trained on how to maintain a small vermicompost bin as a simple method for converting the Kitchen waste.

ZOO608: Animal Behaviour

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
03	DSE	ZOO608	Animal Behavior	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Exhibit critical and integrative thinking skills. Demonstrate ability to communicate scientific information in both oral and written formats. Demonstrate knowledge of key concepts in animal behavior.

UNITS

UN	Name of the Unit {Updated as per SLM Book on 24 Feb 2024}	CSs	Questions
01-01	Behavior	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
01-02	Behavioral Ecology I		
01-03	Behavioral Ecology II		
01-04	Behavioral Ecology III		
02-01	Behavioral Ecology Iv	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks
02-02	Aggression I		
02-03	Aggression II		
02-04	Territoriality I		
03-01	Territoriality II	CR 03 MLs 41-60	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks
03-02	Conflict Behavior I		
03-03	Conflict Behavior II		
03-04	Biological Communication I		
04-01	Biological Communication II	CR 04 MLs 61-80	(LAQ may contain sub-questions (a), (b) and so on.)
04-02	Biological Communication III		
04-03	Orientation And Navigation I		
04-04	Orientation And Navigation II		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit {Updated as per SLM Book on 24 Feb 2024}	CR
1-1	Behavior: Introduction, Study and Scope of Animal Behavior	CR 01
1-2	Behavioral Ecology I: Feeding and Antipredator Behavior	
1-3	Behavioral Ecology II: Food preferences, Feeding Techniques, Using Tools, Feeding in Group living Herbivores, Social Carnivores	
1-4	Behavioral Ecology III: Anti Predator Behavior, Concealment, Camouflage, Warning Coloration and Mimicry.	
2-1	Behavioral Ecology IV: Freezing, Escape, Social Antipredator Behavior, Confusion Effect, Detection, The Development of Anti Predator Behavior.	CR 02
2-2	Aggression I: Forms of Aggressive Behavior, Aggression and Competition	
2-3	Aggression II: Types of Aggressive Behavior.	
2-4	Territoriality I: Social Use of Space (Territoriality), Size and Boundaries of Territory, Territorial Model, Dominance Hierarchies.	
3-1	Territoriality II: Dominance in Females, Dominance in males, Advantage of Dominance, Factors Affecting aggression, Limbic System, Hormones, Genetic Control.	CR 03
3-2	Conflict behavior I: External factors in Aggression, Learning and Experience, Pain and Frustration.	
3-3	Conflict behavior II: Xenophobia, Crowding, Breeding, Feeding, Restrain of Aggression, Displays, Territorial Conflicts	
3-4	Biological Communication I: How signal convey information, Discrete and Graded Signals, Distance and Duration.	
4-1	Biological Communication II : Composite Signals, Syntax and Context, Meta communication, Information and Manipulation, Messages and their Meaning, Signals	CR 04
4-2	Biological Communication III : Measurement of Communication, Observation, Quantification, Channels of Communication, Odor, Sound, Touch, Surface Vibration, Electric Field, Vision	
4-3	Orientation and Navigation I: Navigation, Topographical features, SUN	
4-4	Orientation and Navigation II: Stellar Cues, Olfactory Cues, Geomagnetic Cues, Mammals	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO6o8	Animal Behavior, – Miss. P. A. Dhage	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			

ZOO6o8:RB1	Field and Laboratory Exercises in Animal Behavior, -Tillberg, Chadwick V.; Breed, Michael D.; Hidders, Sarah J.	2007	Academic Press.
ZOO6o8:RB2	Behavior of Animals, -Bolhuis, Johan J.	2004	978-0878930050 Wiley-Blackwell
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO6o8:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO6o8:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Exhibit critical and integrative thinking skills.
2. Demonstrate ability to communicate scientific information in both oral and written formats.
3. Demonstrate knowledge of key concepts in animal behavior.

SEMESTER 04

ZOO609: Animal Physiology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	DSC	ZOO609	Animal Physiology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	Objectives of this course are: <ol style="list-style-type: none">Develop knowledge about the functions of organs and tissues in animals, including humans.Have an appreciation of how the parts of the body are linked into a functioning whole.Understand the principle of homeostasis and the methods used by the body to maintain this.

UNITS

UN	Name of the Unit (REVISED SYLLABUS 18 AUG 2023)	CSs	Questions
01-01	Physiology of Digestion	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
01-02	Absorption and Assimilation of Various Food Stuffs		
01-03	Physiology of Stimulation and Contraction		
01-04	Innervation of muscles		
02-01	Physiology of Respiration	CR 02 MLs 21-40	• Very Short Answer Question (VSAQ), of 03 marks
02-02	Mechanism of respiration		
02-03	Physiology of Nervous system		
02-04	Synaptic Transmission and Neurotransmitters		
03-01	Physiology of Circulation and Cardiovascular System	CR 03 MLs 41-60	• Short Answer Question (SAQ), of 05 marks
03-02	Blood vessels and circulation		
03-03	Physiology of Excretion		
03-04	Structure of a Neuron		

04-01	Physiology of Reproduction	CR 04 MLs 61-80	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
04-02	Physiology of Endocrine Glands		
04-03	Physiology of Defense		
04-04	Complement system		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Physiology of Digestion: Nutritive requirements, Patterns of Digestion, Mechanisms of food intake and feeding mechanisms,	CR 01
1-2	Absorption and Assimilation of Various Food Stuffs: Role of digestive Enzymes, Regulation of appetite and feeding behavior.	
1-3	Physiology of Stimulation and Contraction: Structure, types and Characteristics of skeletal muscle, Mechanism of Muscle Stimulation and Contraction	
1-4	Innervation of Muscles: Skeletal muscle fiber types, Contractile machinery of smooth muscle	
2-1	Physiology of Respiration: Internal and external respiration, Respiratory anatomy, Pulmonary respiration, Gas exchange and transport of gases, Exchange of gases at respiratory surface	CR 02
2-2	Mechanism of Respiration: Regulation of ventilation in lungs, Respiratory Pigments, Respiratory control-Neuronal control of respiration, role of central and peripheral receptors.	
2-3	Physiology of Nervous System: Structure of a Neuron, function of neurons, Generation of Nerve Impulsion and Propagation	
2-4	Synaptic Transmission and Neurotransmitters: Concept of Sensory Receptors (Chemo and Photo), motor control.	
3-1	Physiology of Circulation and Cardiovascular System: Structure of Heart, Pace maker, Cardiac Cycle, Origin and conduction of heart beat,	CR 03
3-2	Blood vessels and circulation: blood pressure regulation, Hemodynamics, Homeostasis and Blood Clot Formation.	
3-3	Physiology of Excretion: Excretory organs and general mechanisms of excretion, Functions of Kidney , Excretion Urea production – Hans Krebs and Kurt Hensley cycle, Urine Formation	
3-4	Structure of a Neuron: filtration, reabsorption and secretion, Osmoregulation Concept of Homeostasis	
4-1	Physiology of Reproduction: Male and female reproductive system of mammals, hormonal control of spermatogenesis, hormonal control of menstrual cycle.	CR 04
4-2	Physiology of Endocrine Glands: Structure and functions of pituitary, thyroid, parathyroid, pancreas and adrenal glands.	
4-3	Physiology of Defense: Innate and adaptive immunity, Types of Immune response, cells and organs of immune system, Antigens and antibodies, their interaction, generation of antibody diversity.	
4-4	Complement System: MHC and antigen presentation, Cytokines, hypersensitivity reactions, tolerance and autoimmunity, Vaccines and immunization.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO609	Animal Physiology, - Dr. Sujata Magdum	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO609:RB1	Animal Physiology - Adaptation & Environment. 4 th Edition, -Knut Schmidt - Nielsen	1990	978-8131512678 Cambridge University Press.
ZOO609:RB2	Principles of Animal Physiology (Contemporary Biology), 3rd Edition, - Wood Dennis W.	2017	978-0713128611 Hodder Arnold
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO609:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO609:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Inculcate critical thinking to carry out scientific investigation objectively.
2. Equip the student with skills to analyze problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.
3. Prepare students for pursuing research or careers in industry in Animal Sciences and applied fields.

ZOO610: Ichthyology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	DSC	ZOO610	Ichthyology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are::</p> <ol style="list-style-type: none"> Define, describe, and explain the following concepts as they relate to fishes. Speciation, phylogeny, life history, biogeography, ecology, osmoregulation, reproductive mode, and biodiversity.

UNITS

UN	Name of the Unit {Updated as per SLM Book on 24 Feb 2024}	CSs	Questions
01-01 01-02 01-03 01-04	Classification of Fishes Fish Phylogeny External Morphology of Fish Endoskeleton	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
02-01 02-02 02-03 02-04	Digestive system Respiration Buoyancy mechanisms Excretion and Osmoregulation	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks
03-01 03-02 03-03 03-04	Catadromous and Anadromous fish Reproduction In Fishes Nervous system and Sense organs Endocrine organs	CR 03 MLs 41-60	<ul style="list-style-type: none"> Long Answer Question (LAQ) of 10 Marks
04-01 04-02 04-03 04-04	Ecosystem Fish Nutrition Aquaculture – Freshwater, Marine Water and Costal Water Aquatic Pollution	CR 04 MLs 61-80	(LAQ may contain sub-questions (a), (b) and so on.)

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit {Updated as per SLM Book on 24 Feb 2024}	CR
1-1	Classification of Fishes: Classification and diagnostic characters-up to orders, of extant Cyclostomata, Chondrichthyes and Osteichthyes, 9 major orders of fishes.	CR 01
1-2	Fish Phylogeny: Phylogeny of fishes	
1-3	External Morphology of Fish: External morphology, body form, appendages, pigmentation, skin and scales. Principles of morphometry, Locomotion	
1-4	Endoskeleton: Skull, axial and appendicular skeleton	
2-1	Digestive system: Food and feeding habits, Digestive system and its anatomical modifications	CR 02
2-2	Respiration: Structure and functions of gills; adaptations for air breathing; role of air bladder. Respiratory functions of food	
2-3	Buoyancy mechanisms: Role of fat and swim bladder	
2-4	Excretion and Osmoregulation: Excretion and Osmoregulation; Glomerular and aglomerular kidneys; Nitrogen (ammonia, urea, TMAO) excretions; water and salt and balance in steno- and euryhaline fishes. Role of skin and gills	
3-1	Catadromous and Anadromous Fish: Catadromous and anadromous fishes.	CR 03
3-2	Reproduction In Fishes: Structure of gonads, gametogenic cycles; spawning, Parental care	
3-3	Nervous system and Sense organs: Organization of the central and peripheral nervous systems. Eye, lateral line organs and chemoreceptors	
3-4	Endocrine organs: Functions of the pituitary, thyroid, inter-renal and chromaffin tissues, ultimobranchial and corpuscles of Stannius	
4-1	Ecosystem: Zonations, Characteristics, Morphometry of fresh water resources; Stratification and dynamics of oxygen, nitrogen, phosphorus and inorganic carbon.	CR 04
	Fish nutrition – Stages of nutrient acquisition, Temporal pattern of nutrient acquisition, Integration of nutrient acquisition. Principles of fish nutrition and terminologies, nutritional requirement of cultivable fish and prawn; Nutritional bioenergetics.	
4-2	Aquaculture – Freshwater, Marine Water and Coastal Water	
4-3	Aquatic pollution: Aquatic pollution and its impact on fisheries, Eutrophication.	
4-4	Ecosystem: Zonations, Characteristics, Morphometry of fresh water resources; Stratification and dynamics of oxygen, nitrogen, phosphorus and inorganic carbon.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			

Text-Books			
ZOO610	Ichthyology, - Dr. A. R. Kurhe	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO610:RB1	Fish and Fisheries of India, - Jhingran	1985	978-8170750178 Hindustan Publishing Corporation
ZOO610:RB2	Textbook of Fish Biology and Fisheries - Khanna and Singh	2003	978-9384337124 Narendra Publishing
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO610:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO610:WL1			

COURSE OUTCOMES
<p>After successful completion of this course, student should be able to:</p> <ol style="list-style-type: none"> 1. Distinguish families and higher taxonomic groups of fishes with respect to their physical features. 2. Draw patterns of phylogenetic relationships among various groups of fishes and to understand the evolutionary significance of features mapped on these phylogenetic trees. 3. Understand the aquaculture practices of cold water, sewage fed, exotic fishes, larvivorous and carp fish 4. To understand the various fishing gear, pond and hatchery management and breeding techniques of various fish species 5. To understand the fish preservation techniques and by products of fishery

ZOO611: Lab on Animal Physiology & Ichthyology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023} & V143: M.Sc. (Zoology) {2022}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	DSC	ZOO611	Lab On Animal Physiology & Ichthyology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B. Sc with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Describe the anatomy & physiology of the major systems of the body. To acquaint students with the physiological systems of animals. To acquaint students with habitat dependent change in structure of physiological systems. To acquaint students with habitat dependent change in physiological functions.

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
Animal Physiology (REVISED SYLLABUS 22 AUG 2023)		
1-1	Total Count of WBC's	CR 01
1-2	Total Count of RBC's	
1-3	Estimation of haemoglobin percentage with the help of haemometer	
1-4	Effect of exercise on blood lactate in man	
1-5	Differential Count of WBC's	
2-1	Qualitative detection of nitrogenous waste products (Ammonia, urea, uric acid) in given sample	CR 02
2-2	Effect of insulin on blood sugar level of mice	
2-3	To determine bleeding time and clotting time of human blood	
2-4	Determination of Body Mass Index (BMI)	
2-5	Determination of blood pressure by Sphygmomanometer	

Ichthyology {Updated as per SLM Lab Manual on 24 Feb 2024}		
3-1	Study of Fish Identification and classification-catla, Rohu and Mrigala and Pomfret	CR 03
3-2	Study of external characters & digestive system of locally available fish (E)	
3-3	Study the types of scales (Placoid scale, Cycloid scale, Ctenoid scale & Ganoid)	
3-4	Study of tail fins in fishes (Homocercal, Heterocercal & Diphyrcercal) (D)	
3-5	Study of brain of fish(Locally available)	
4-1	Study the measurement of physiological parameters like oxygen consumption or metabolic rates	CR 04
4-2	Identifying and documenting fish parasites using microscopy	
4-3	Aquarium design and maintenance	
4-4	Study of crafts and gears in fisheries	
4-5	Visit to freshwater/ marine fish farm- Visiting aquaculture facilities to understand fish farming techniques	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO611	Lab on Animal Physiology & Ichthyology, Dr. V. R. Kakulte & Dr. A. R. Kurhe		
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO611:RB1	Comp. Animal Physiology, Ladd Prosser		W. B. Saunders, Philadelphia.
ZOO611:RB2	Comp. Animal Physiology, William Hoar.		E.E.E., IBH
ZOO611:RB3	Animal Physiology – Adaption and function , F. Reed Hainswoth		Addison – Wesley Publ. Company
ZOO611:RB4	Animal Physiology by Kent Schmidt Nielson		E.E.E., IBH.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO611:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO611:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. An understanding of the various physiological systems of animals.
2. An understanding of structural differences in the physiological systems of animals from varied habitats.
3. An understanding of the functional differences in animal's physiological systems.

ZOO612: Research Project – II

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Other	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	RP	ZOO612	Research Project-II	6	12	120	75	75	150	PW

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: <ul style="list-style-type: none">B.Sc. with Zoology or equivalent from a recognized University/Board.	The objectives of this course are: <ol style="list-style-type: none">To develop technical skill.To empower our students with practical skills to comprehend the physiology and other functions of each and every vital systems.

GUIDELINES:

No	Guidelines for the Students and Study Centers for the conduct of Project
1	The “Project Work” course aims to imbibe in students the principle that working is learning. Learning and working are two sides of the same coin and thus, work experience enhances the learning.
2	This course is based on preliminary research oriented topics both in theory and experiment. The subject expert/ counselor will act as supervisors for the projects. Project shall be on the current and relevant topics and issues. Project topic is jointly finalized by the student and the project supervisors through discussion. At the completion of the project by the semester end, the student will submit a Project Report in the form of Dissertation which will be examined by the examiners. The end examination shall consist of (a) Presentation and (b) Comprehensive viva-voce.
3	Students are expected to work on “Project Work” for about 6 hours per week (About 2 hour’s self-study at residence and 12 hours in counseling session at study centre), during a semester. Thus only those projects, demanding such study efforts on all those activities, listed in above, should be selected.
4	A single student will have to do a project. Since. The student invests his energy, time and resources in a project. The project therefore should, have important focus on some relevant practical aspects. This will

	help student to justify his efforts on project.
5	Employed Students are allowed to complete “Project Work” in the industry where he/she is employed or his/ her place of choice. Such a student has to identify a resource person in industry, who can take responsibility of guiding him in project work. Such person should be eligible to work as “Project Guide”.
6	Study centre should assist unemployed students, in locating sponsored “Projects” from local industries. Students are encouraged to locate sponsored projects from the local industries. But, in case, a student is unable to locate such project, he is also allowed to complete “Project Work” at his study center.
7	The Project Work must involve practical research work related to your selected discipline.
8	Students have to finance expenditure on “Project” by his own. Hence students should select those projects, accordingly.
9	Each “Project Guide” may be assigned maximum 5 students.
10	The original design requirements are not essential , although highly encouraged. Hence, normally, projects should not be repeated. The same project undertaken in recent past, by past students, should be avoided. But it is most important that, students must put his independent study efforts on the project. Thus, student should gain practical project execution knowledge about making some useful product, after he goes through all projects completion steps listed above.
11	<p>There project report should be file bound/spiral bound/hard bound and should have following format</p> <p>Title Page/Cover page Certificate endorsed by Project Guide/Supervisor, Learner Support Center Coordinator and Head Declaration for followed ethical practice and non-plagiarism Acknowledgement Abstract of the project Table of Contents List of Figures List of Tables Chapters of Project Report –</p> <p>Chapter 1: Introduction: Background of the project, Need for the project, Brief idea of the project, Literature review, Aims and Objectives of the project</p> <p>Chapter 2: Design and Methodology: overview of the complete project, the scientific principles involved in the design of the project, Block Diagrams, Experimental/Theoretical Methodology/Circuit/Model/ materials required, etc.</p> <p>Chapter 3: Testing, Conduct of Experiment/ Module: Actual conduct of experiment, measurements, observations, etc.</p> <p>Chapter 4: Analysis of Data: Analysis of the data and observations received during experimentation</p> <p>Chapter 5: Results, Discussion and Conclusions: Discuss why the specifications were not met or the reasons for the failure, if any. Discussed the problems and difficulties encountered and how they were / can be eliminated. Discuss any extension work or modifications, which you want to suggest.</p> <p>Chapter 6: References: List the books, reference books, journals, websites, magazines and data manuals used, etc.</p>
12	Project Report Submission Process: Student should prepare 2 copies of the Project Report. At the beginning, the respective Project Guide must approve both

	<p>copies positively before the end examination of Project Work. Then respective Study Center Coordinator approves both copies of the Project Report. Student should submit one of these approved copies to the study center. The student should retain remaining one of these approved copies. Study center should preserve their copy of, all project reports, till the end examination of Project Work. Even student must bring his own copy during this end examination.</p>				
13	<p>Project Report Format:</p> <ol style="list-style-type: none"> 3. The project report should be printed on only right side of A4 size (210 mm ´ 297 mm) paper. There is no minimum or maximum page number limit for the “Project Report”, but report of minimum 50–70 pages is expected. University recommends only flexible binding for the “Project Report”. But, if student wishes, he may also use spiral binding. 4. Margins should be as follows: <ul style="list-style-type: none"> ▪ Left Margin : 40mm ▪ Right Margin : 20mm ▪ Top Margin : 20mm ▪ Bottom Margin : 27mm 5. Header should not be used. Footer, containing page number at the center should only be used, with footer margin of 25mm. 6. Text should be printed in font size of 12 points and at interline distance of 18 points. (That is 1.5 line spacing). Normally, figures should be embedded in the text, where there first reference occurs. But if necessary, figures may be grouped on separate pages. Figure should be numbered as ‘Fig C.F’, where ‘C’ is chapter number and ‘F’ is figure number. Figure number ‘F’ is reset back to 1 for each new chapter. <p>Page Sequence: (1) Cover page as per specimen 1 (2) Certificate page as per specimen 2 (3) Acknowledgement page for the help offered by individuals and institution (4) Content page as per specimen 3. Following suggested scheme of chapters in project report then follows these first 4pages.</p>				
14	<p>Specimen of Pages</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">Specimen 2</p> <p style="text-align: center;">Certificate</p> <p>This is to certify that</p> <p>Mr /Ms.....</p> <p>.....(PRN ...)</p> <p>has successfully completed a project entitled "..... "</p> <p>in partial fulfillment for the requirement of</p> <p style="text-align: center;">Master of Science in</p> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center; padding: 5px;">Signature with Date</td> </tr> <tr> <td style="width: 50%; text-align: center; padding: 5px;">Project Guide</td> <td style="width: 50%; text-align: center; padding: 5px;">LSC Coordinator</td> </tr> </table>	Signature with Date		Project Guide	LSC Coordinator
Signature with Date					
Project Guide	LSC Coordinator				

Specimen 1 Project Title- M.Sc. in Submitted by Name of Student- Name of Project Guide- Name of the Learner Support Center– Yashwantrao Chavan Maharashtra Open University 20... - ...	Internal Examiner	External Examiner

COURSE OUTCOMES

After successful completion of this course, student should be able to –

1. Demonstrating a high level of research competence, having successfully planned and executed a master's-level research project.
2. Honed their critical thinking abilities, demonstrated by the comprehensive literature review and critical analysis of research findings.
3. Proficient in selecting appropriate research design and methodologies, ensuring the research is well-structured and methodologically sound.
4. Demonstrating expertise in collecting and analyzing data, utilizing appropriate statistical or qualitative analysis techniques.
5. Developing effective project management skills, successfully meeting research milestones and completing the project within the given timeframe.
6. Problem-solving abilities, adapting their research strategies to overcome challenges encountered during the research process.

Elective Courses

ZOO613: Comparative Animal Physiology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	DSE	ZOO613	Comparative Animal physiology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are::</p> <ol style="list-style-type: none"> Acquire a fundamental knowledge of “how animals work” Recognize how prior and new knowledge relate to current/future work. Appreciate the importance of animal physiology. Understand how to collect, integrate, and communicate information.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Comparative Study of Physiology	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
01-02	Food Digestive Mechanism		
01-03	Coordination of digestive activities		
01-04	Comparative aspects of carbohydrate pathways		
02-01	Oxygen Transport	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
02-02	Adaptation in Respiration		
02-03	Comparative aspects of transport		
02-04	Respiratory pigments		
03-01	Osmoregulation	CR 03 MLs 41-60	
03-02	Excretory Physiology		
03-03	Adaptation		
03-04	Thermoregulation		
04-01	Chronic obstructive pulmonary disease	CR 04 MLs 61-80	
04-02	Liver		
04-03	Electrolyte imbalance		
04-04	Heat stroke		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Comparative Study of Physiology: Scope, principles and validity of comparative approach to physiology, Origin of nutritive types - special dietary requirements of some animals, amino acid requirements, and essential vitamins	CR 01
1-2	Food Digestive Mechanism: Mechanisms of food intake and feeding mechanisms, comparative physiology of digestive enzymes and regulatory mechanism of digestion	
1-3	Coordination of digestive activities: Coordination of digestive activities - visceral autonomic system and gastro intestinal hormones	
1-4	Comparative aspects of carbohydrate pathways: Comparative aspects of carbohydrate pathways - Glycolysis and gluconeogenesis, pathways and regulation.	
2-1	Oxygen Transport: Availability of oxygen, uptake of oxygen and factors that it influence uptake	CR 02
2-2	Adaptation in Respiration: Oxygen consumption by intact animal, modifying agents. Adaptations to diving and high altitudes.	
2-3	Comparative aspects of transport: Comparative aspects of transport of oxygen and carbon dioxide; regulation of respiration	
2-4	Respiratory pigments: Respiratory pigments in different phylogenetic groups, genes with reference to hemoglobin	
3-1	Osmoregulation: Problem of osmoregulation and biological responses in different environments. Comparative aspect of osmoregulation in different animal groups	CR 03
3-2	Excretory Physiology: Excretory organs and general mechanisms of excretion in various animal groups.	
3-3	Adaptation: Freezing, winter hardening, lethal limits and resistance adaptation; behavioral and locomotory adaptations; heat regulation - physical and chemical.	
3-4	Thermoregulation: Temperature regulation in homeotherms; neural mechanism of thermoregulation.	
4-1	Chronic obstructive pulmonary disease: Asthma, sleep apnea, and snoring, Effects of colonic bacterial flora -beneficial and harmful effect; lactose intolerance, GERD	CR 04
4-2	Liver: Liver cirrhosis and its causative agents; fatty liver.	
4-3	Electrolyte imbalance: Electrolyte imbalance - Acidosis, alkalosis; Dialysis	
4-4	Heat stroke: Heat stroke; thirst and its physiological mechanism.	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			

Text-Books			
ZOO613	Comparative Animal Physiology, – Dr. V. R. Kakulte	2023	YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO613:RB1	Comparative Animal Physiology, -C. Ladd Prosser (4th ed.)	1991	Wiley-Liss
ZOO613:RB1	Comparative Animal Physiology, -Philip C. Withers	1992	Brooks/Cole
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO613:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO613:WL1			

COURSE OUTCOMES			
After successful completion of this course, student should be able to:			
<ol style="list-style-type: none"> 1. Explore the basic physiological principles common to animals, relating structure to function 2. Understand all physiological processes of vertebrates & analyse them biochemically 3. Correlate the comparative physiology of the systems and understand their regulation & control 4. Compare the structure, functions and regulation of the receptor organs of vertebrates 5. Understand the structure, function and regulation of endocrine & neuroendocrine glands 			

ZOO614: Aquaculture

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	DSE	ZOO614	Aquaculture	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Develop knowledge of farming of aquatic organisms for increasing food production and animals beneficial to human. Observe culture techniques, farm management and hatchery operations. Analyse harvesting and marketing strategies. Understand the technique of fish preservation and Water quality monitoring techniques.

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Introduction to Aquaculture	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
01-02	Aquatic Species in Aquaculture		
01-03	Aquaculture Systems and Facilities		
01-04	Aquaculture Engineering		
02-01	Aquaculture Nutrition	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
02-02	Fish Health and Disease Management		
02-03	Water Quality Management		
02-04	Reproduction and Breeding Techniques		
03-01	Hatchery Operations	CR 03 MLs 41-60	
03-02	Grow-Out Culture		
03-03	Integrated Multi-Trophic Aquaculture (IMTA)		
03-04	Aquaculture and Sustainability		
04-01	Aquaculture Economics and Marketing	CR 04 MLs 61-80	
04-02	Aquaculture Policy and Regulations		
04-03	Technologies in Aquaculture		
04-04	Case Studies and Industry Visits		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Introduction to Aquaculture : Scope, definition and its significance in addressing global food security Historical development of aquaculture practices	CR 01
1-2	Aquatic Species in Aquaculture: Overview of species cultured in aquaculture (fish, crustaceans, mollusks, algae) Selection criteria for species based on market demand, growth rate, adaptability, etc	
1-3	Aquaculture Systems and Facilities : Different types of aquaculture systems (ponds, tanks, raceways, cages, recirculating systems) Design and construction of aquaculture facilities	
1-4	Aquaculture Engineering: Design and construction of pond Layout and design of aquaculture farm, construction, water intake system, drainage system; aeration and aerators Hydrology of Ponds, sources of water – precipitation Design and construction of hatcheries	
2-1	Aquaculture Nutrition: Principles of nutrition for various cultured species Formulation of feeds, feed ingredients, and feed conversion ratios Nutritional requirements of cultivable finfish and shellfish	CR 02
2-2	Fish Health and Disease Management: Common diseases in aquaculture and their causes Disease prevention, diagnosis, and treatment Biosecurity measures to prevent disease outbreaks	
2-3	Water Quality Management : Importance of maintaining optimal water quality for healthy growth Parameters monitored (pH, dissolved oxygen, ammonia, nitrite, temperature) Water treatment and quality improvement techniques	
2-4	Reproduction and Breeding Techniques : Principles of selective breeding and genetic improvement Techniques for inducing reproduction and controlling spawning	
3-1	Hatchery Operations : Brood stock management and conditioning Larval rearing techniques and nursery operations	CR 03
3-2	Grow-Out Culture : Feeding strategies and feeding management at different growth stages Stocking density, growth monitoring, and size grading	
3-3	Integrated Multi-Trophic Aquaculture (IMTA) : Concept of combining multiple species in a single aquaculture system Environmental benefits and waste management in IMTA	
3-4	Aquaculture and Sustainability : Environmental impacts of aquaculture and mitigation strategies Certification programs and sustainable aquaculture practices	

4-1	Aquaculture Economics and Marketing : Cost analysis, economic feasibility, and return on investment Market trends, value chain, and product marketing	CR 04
4-2	Aquaculture Policy and Regulations : Government policies, regulations, and standards related to aquaculture Role of international organizations in aquaculture development	
4-3	Technologies in Aquaculture : Application of biotechnology, genomics, and other advanced techniques Automated monitoring systems and precision aquaculture	
4-4	Case Studies and Industry Visits: Analyzing successful aquaculture projects and case studies Visiting commercial aquaculture facilities for practical exposure	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			
Text-Books			
ZOO614	Aquaculture, – Dr. Anil Kurhe		YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO614:RB1	Hand book of fisheries & Aquaculture, - Ayappan, S	2011	9788171641062 ICAR Publication
ZOO614:RB2	Fisheries Science, - Santhanam	1990	978-9351249450 Daya Publishing House
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO614:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO614:WL1			

COURSE OUTCOMES

After successful completion of this course, student should be able to:

1. Field oriented Training programmes and skill development programme.
2. Internship for Outgoing students in Aquaculture Labs, Hatcheries, Farming, Marketing
3. Provides knowledge on Livestock, improvement aquaculture and pearl culture
4. Provides knowledge on Intellectual property rights and genetically modified organisms

ZOO615: Parasitology

PROGRAMME INFORMATION

SN	Description	Details
1	University	Yashwantrao Chavan Maharashtra Open University Nashik - 422 222, Maharashtra, India Website: http://www.ycmou.ac.in/ and http://ycmou.digitaluniversity.ac/
2	School	School of Sciences
3	Discipline	Science
4	Level	PG
5	Course Used in	V155: M.Sc. (Zoology) {2023}

COURSE INFORMATION

Sem	Major	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
04	DSE	ZOO615	Parasitology	4	12	120	30	70	100	T

PRESUMED KNOWLEDGE AND LEARNING OBJECTIVES

Presumed Knowledge	Learning Objectives
<p>For successful completion of this course, student should have successfully complete:</p> <ul style="list-style-type: none"> B.Sc. with Zoology or equivalent from a recognized University/Board. 	<p>Objectives of this course are:</p> <ol style="list-style-type: none"> Identify and describe different types of parasites and their characteristics. Understand the life cycles and transmission patterns of major parasites. Analyze the pathogenesis and clinical manifestations of parasitic infections. Explore the epidemiology

UNITS

UN	Name of the Unit	CSs	Questions
01-01	Introduction, Scope and Branches of Parasitology	CR 01 MLs 01-20	As per evaluation pattern, on Each Credit , Student is required to answer
01-02	Host parasite Relationship		
01-03	Malaria (Plasmodium species)		
01-04	Trypanosomiasis (Trypanosoma species)		
02-01	Leishmaniasis (Leishmania species)	CR 02 MLs 21-40	<ul style="list-style-type: none"> Very Short Answer Question (VSAQ), of 03 marks Short Answer Question (SAQ), of 05 marks Long Answer Question (LAQ) of 10 Marks (LAQ may contain sub-questions (a), (b) and so on.)
02-02	Intestinal Helminths		
02-03	Tissue-dwelling Helminths		
02-04	Fleas (Siphonaptera)		
03-01	Ticks (Ixodida)	CR 03 MLs 41-60	
03-02	Lice (Phthiraptera)		
03-03	Diagnostic Techniques for Parasitic Infections		
03-04	Parasite Life Cycles and Transmission		
04-01	Mechanisms of Pathogenesis	CR 04 MLs 61-80	
04-02	Geographic Distribution of Parasitic Diseases		
04-03	Control and Treatment of Parasitic Infections		
04-04	Impact of Parasitic Diseases on Public Health and Veterinary Medicine		

DETAILED SYLLABUS

UN	Detailed Syllabus of the Unit	CR
1-1	Introduction, Scope and Branches of Parasitology: Definition: host, parasite, vector, commensalisms, mutualism and parasitism. Classification of parasites Host-parasite interactions, Types of parasites and Hosts, Electro parasite, endoparasite and its subtypes, Type of host - intermediate, definitive, paratenic and reservoir	CR 01
1-2	Host parasite Relationship: Host specify, Types of host specifies : Structure specificity, physiological specificity and ecological specify, Effect of parasite on host	
1-3	Malaria (Plasmodium species): Life cycle and transmission, Pathogenesis and clinical manifestations, Diagnosis and treatment, Amoebiasis (Entamoeba histolytica): Life cycle and transmission, Pathogenesis and clinical manifestations, Diagnosis and treatment	
1-4	Trypanosomiasis (Trypanosoma species): Life cycle and transmission, Pathogenesis and clinical manifestations, Diagnosis and treatment	
2-1	Leishmaniasis (Leishmania species): Life cycle and transmission, Pathogenesis and clinical manifestations, Diagnosis and treatment	CR 02
2-2	Intestinal Helminths (e.g., Ascaris, hookworms, whipworms): Life cycles and transmission, Pathogenesis and clinical manifestations, Diagnosis and treatment	
2-3	Tissue-dwelling Helminths (e.g., Filarial worms): Life cycles and transmission, Pathogenesis and clinical manifestations, Diagnosis and treatment	
2-4	Fleas (Siphonaptera): Types of fleas and their hosts, Role in disease transmission, Control and prevention	
3-1	Ticks (Ixodida): Types of ticks and their hosts, Role in disease transmission Control and prevention	CR 03
3-2	Lice (Phthiraptera): Types of lice and their hosts, Role in disease transmission Control and prevention	
3-3	Diagnostic Techniques for Parasitic Infections: Microscopic examination of parasites, Serological and molecular diagnostic techniques	
3-4	Parasite Life Cycles and Transmission: Direct and indirect life cycles, Vector-borne transmission	
4-1	Mechanisms of Pathogenesis: How parasites cause disease in hosts, Immune responses and evasion	CR 04
4-2	Geographic Distribution of Parasitic Diseases: Factors influencing disease prevalence Endemic vs. epidemic areas	
4-3	Control and Treatment of Parasitic Infections: Antiparasitic drugs and their mechanisms of action, Preventive measures and public health strategies	
4-4	Impact of Parasitic Diseases on Public Health and Veterinary Medicine: Economic impact, Zoonotic potential, One Health approach	

LEARNING RESOURCE DETAILS

LR Code	Title Author	Edition Year	ISBN Publisher
Course Website Link for (1) Mobile and Online Lectures, (2) Discussion Forum for online interaction and (3) Self-Test for each CR Block, Continuous Assessment Test and End Examination			

Text-Books			
ZOO615	Parasitology, – Dr. Anil Kurhe		YCMOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO615:RB1	Textbook of Parasitology, - Belding, D. L. Meredith	1956	New York
ZOO615:RB2	Medical Parasitology, - Arora, D. R. and Arora B.	2005	CBS Publishers and Distributors, New Delhi.
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO615:CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
ZOO615:WL1			

COURSE OUTCOMES			
After successful completion of this course, student should be able to:			
<ol style="list-style-type: none"> 1. Understand the life history of vectors and pests, the diseases caused and their control 2. Understand the life history of parasites of domestic animals. 3. Gain knowledge of agro based small scale industries. 4. Study the culture of various organisms for economic benefit. 5. Have a broad array of career options and activities in human medicine, biomedical research and allied health professions 			

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