Maharaja's College Ernakulam

A GOVERNMENT AUTONOMOUS COLLEGE

Re-Accredited by NAAC with 'A Grade'
Affiliated to Mahatma Gandhi University
Centre of Excellence under Govt. of Kerala
Identified by UGC as College with Potential for Excellence

POST GRADUATE AND RESEARCH

DEPARTMENT OF ZOOLOGY

Estd. 1875

Under Graduate Curriculum and Syllabus

(Choice Based Credit Semester System)

B. Sc. ZOOLOGY

For 2020 Admission Onwards

Maharaja's College, Ernakulam

(A Government Autonomous College)

Affiliated to Mahatma Gandhi University, Kottayam

Under Graduate Programme in Zoology

2020 Admission Onwards

Board of Studies in Zoology

Sl. No.	Name of Member	Designation
1	**Dr. M.H.Shyla (HOD)**	Chairman, BoS Zoology
2	**Dr. P.Radhakrishnan**	External Member
3	**Dr. Shaju Thomas**	External Member
4	**Dr. Rishad. K.S**	External Member [Industry]
5	**Dr. A. Gopalakrishnan**	External Member [Alumni]
6	**Dr. K.S.Sunish**	Internal Member
7	**Smt. Anitha Abraham**	Internal Member
8	**Sri. Janish.P.A**	Internal Member
9	**Dr. Prakasan.K**	Internal Member
10	**Smt. Dhanya Balakrishnan**	Internal Member
11	**Smt. Sandhya Krishnan.K.R**	Internal Member

MAHARAJA'S COLLEGE, ERNAKULAM
(A GOVERNMENT AUTONOMOUS COLLEGE)
REGULATIONS FOR UNDER GRADUATE PROGRAMMES

UNDER CHOICE BASED CREDIT SYSTEM 2020

1. TITLE

1.1. These regulations shall be called "**MAHARAJA'S COLLEGE (AUTONOMOUS) REGULATIONS FOR UNDER GRADUATE PROGRAMMESUNDER CHOICE BASED CREDIT SYSTEM 2020**"

2. SCOPE

2.1 Applicable to all regular Under Graduate Programmes conducted by the Maharaja's College with effect from 2020 admissions

2.2 Medium of instruction is English except in the case of language courses other than English unless otherwise stated therein.

2.3 The provisions herein supersede all the existing regulations for the undergraduate programmes to the extent herein prescribed.

3. DEFINITIONS

3.1. ***'Academic Week'*** is a unit of five working days in which the distribution of work is organized from day one to day five, with five contact hours of one hour duration on each day.

3.2. **'Choice Based Course**' means a course that enables the students to familiarize the advanced areas of core course.

3.3. ***'College Coordinator'*** is a teacher nominated by the College Council to co-ordinate the continuous evaluation undertaken by various departments within the college. He/she shall be nominated to the college level monitoring committee.

3.4. ***'Common Course I'*** means a course that comes under the category of courses for English.

3.5 ***'Common Course II'*** means additional language.

'Complementary Course' means a course which would enrich the study of core courses.

3.6. ***'Core course'*** means a course in the subject of specialization within a degree programme. It includes a course on environmental studies and human rights.

3.7. ***'Course'*** means a portion of a subject to be taught and evaluated in a semester (similar to a paper under annual scheme).

3.8. ***'Credit'*** is the numerical value assigned to a paper according to the relative importance of the syllabus of the programme**.**

3.9. ***'Department'*** means any teaching department in a college.

3.10. ***'Department Coordinator'*** is a teacher nominated by a Department Council to co- ordinate the continuous evaluation undertaken in that department.

3.11. ***'Department Council'*** means the body of all teachers of a department in a college.

3.12. ***'Faculty Advisor'*** means a teacher from the parent department nominated by the Department Council, who will advise the student on academic matters.

3.13. ***Grace Marks*** shall be awarded to candidates as per the University Orders issued from time to time**.**

3.14. ***'Grade'*** means a letter symbol (A, B, C, etc.), which indicates the broad level of performance of a student in a Paper/Course/ Semester/Programme.

3.15. ***'Grade Point'*** (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

3.16. ***'Parent Department'*** means the department which offers core course/courses within an undergraduate programme.

3.17. ***'Programme'*** means a three year programme of study and examinations spread over six semesters, the successful completion of which would lead to the award of a degree.

3.18. ***'Semester'*** means a term consisting of a minimum **90** working days, inclusive of tutorials, examination days and other academic activities within a period of six months**.**

3.19. ***'Vocational Course'*** **(Skill Enhancement Course)** means a course that enables the students to enhance their practical skills and ability to pursue a vocation in their subject of specialization.

4. ELIGIBILITY FOR ADMISSION AND RESERVATION OF SEATS

4.1 Eligibility for admissions and reservation of seats for various Undergraduate Programmes shall be according to the rules framed by the University/ State Government in this regard, from time to time.

5. DURATION

5.1 The duration of U.G. programmes shall be ***6 semesters***.

5.2 There shall be two Semesters in an academic year, the "ODD" semester commences in June and on completion, the "EVEN" Semester commences. There shall be two months' vacation during April and May.

5.3 No student shall be allowed to complete the programme by attending more than 12 continuous semesters.

6. REGISTRATION

6.1. The strength of students for each programme shall be as per the existing orders, as approved by the University.

6.2. Those students who possess the required minimum attendance during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next class.

7. SCHEME AND SYLLABUS

7.1. The U.G. programmes shall include **(a)** Common Courses I and II, **(b)** Core Course(s), **(c)** Complementary/Vocational Courses, and **(d)** Choice based course**.**

7.2. There shall be Two Choice Based course (Elective Course) in the fifth and sixth semesters. In the case of B.Com Programme there shall be an elective stream from third semester onwards.

7.3. Credit Transfer and Accumulation system can be adopted in the programme. Transfer of Credit consists of acknowledging, recognizing and accepting credits by an institution for programmes or courses completed at another institution. The Credit Transfer Scheme shall allow students pursuing a programme in one college to continue their education in another college without break.

7.4. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass for a course. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual courses. If a candidate secures **F Grade** for any one of the courses offered in a Semester/Programme, **only F grade** will be awarded for that Semester/Programme until he/she improves this to **D Grade** or above within the permitted period. The college shall allow credit transfer, subject to the approval of the concerned board of studies and Academic Council.

7.5. Students discontinued from previous regulations CBCSS 2016, can pursue their studies under the new regulation “Regulations for Under Graduate

Programmes under Choice Based Credit System 2020"after obtaining readmission.

7.6. The practical examinations (external/internal) will be conducted only at the end of even semesters for all programmes. Special sanction shall be given for those programmes which need to conduct practical examinations at the end of odd semesters.

8. PROGRAMME

STRUCTURE Model I/II

BA/B.Sc.

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120
c	Credits required from Common Course I	22
d	Credits required from Common Course II	16
e	Credits required from Core course and Complementary courses including Project	74
f	Choice Based Core Course	8
g	Minimum attendance required	75%

Model I or Model II B.Com

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120

c	Credits required from Common Course I	14
d	Credits required from Common Course II	8
e	Credits required from Core and Complementary/Vocational courses including Project	90
f	Choice Based Core Course	8

g	Minimum attendance required	75%

Model III BA/B.Sc./B.Com

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120
c	Credits required from Common Course I	8
d	Credits required from Core + Complementary + Vocational Courses including Project	109
e	Open Course	3
f	Minimum attendance required	75%

BA Honours

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120

c	Credits required from Common Course I	16
d	Credits required from Common Course II	8
e	Credits required from Core + Complementary + Vocational Courses including Project	93
f	Choice Based Core Course	8
g	Minimum attendance required	75%

9. EXAMINATIONS

9.1 The evaluation of each paper shall contain two parts:

i. Internal or In-Semester Assessment (ISA)

ii. External or End-Semester Assessment (ESA)

9.2. The internal to external assessment ratio shall be 1:4.

Both internal and external marks are to be rounded to the next integer.

All papers (theory & practical), grades are given **on a 7-point scale** based on the total percentage of marks, ***(ISA+ESA)*** as given below:-

Percentage of Marks	**Grade**	**Grade Point**
95 and above	S Outstanding	10
85 to below 95	A^+ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	B^+ Good	7
55 to below 65	B Above Average	6

45 to below 55	C Satisfactory	5
35 to below 45	D Pass	4
Below 35	F Failure	0
	Ab Absent	0

10. CREDIT POINT AND CREDIT POINT

AVERAGE Credit Point (CP) of a paper is

calculated using the formula:- *CP = C × GP,*

where C is the Credit and GP is the Grade point

Semester Grade Point Average (SGPA) of a Semester is calculated using the formula:

SGPA = TCP/TC, where TCP is the Total Credit Point of that semester.

Cumulative Grade Point Average (CGPA) is calculated using the formula:-

CGPA = TCP/TC, where TCP is the Total Credit Point of that programme.

Grade Point Average (GPA) of different category of courses viz. Common Course I, Common Course II, Complementary Course I, Complementary Course II, Vocational course, Core Course is calculated using the formula:-

GPA = TCP/TC, where TCP is the Total Credit Point of a category of course. TC is the total credit of that category of course

Grades for the different courses, semesters and overall programme are given based on the corresponding GPA as shown below:

GPA	**Grade**
9.5 and above	**S Outstanding**

8.5 to below 9.5	**A+ Excellent**
7.5 to below 8.5	**A Very Good**
6.5 to below 7.5	**B+ Good**
5.5 to below 6.5	**B Above Average**
4.5 to below 5.5	**C Satisfactory**
3.5 to below 4.5	**D Pass**
Below 3.5	**F Failure**

11. MARKS DISTRIBUTION FOR EXTERNAL AND INTERNAL EVALUATIONS

The external theory examination of all semesters shall be conducted by the college at the end of each semester. Internal evaluation is to be done by continuous assessment. For all courses without practical total marks of external examination is 80 and total marks of internal evaluation is 20. Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

11.1 For all courses without practical

1.a) Marks of external Examination : 80

1.b) Marks of internal evaluation : 20

Components of Internal Evaluation of theory	Marks
Attendance	**5**
Assignment /Seminar/Viva	**5**

Test papers (2x5=10)(Marks of test paper shall be average)	**10**
Total	**20**

11.2 For all courses with practical total marks for external evaluation is 60 and total marks for internal evaluation is 15.

For all courses with practical

2.a) Marks of external Examination : 60

2.b) Marks of internal evaluation : 15

Components of Internal Evaluation	**Marks**
Attendance	**5**
Seminar/Assignments/Viva	**2**
Test paper (2x4)	**8**
Total	**15**

c. For practical examinations total marks for external evaluation is 40 for internal evaluation is 10

Components of Internal Evaluation (Practicals)	**Marks**
Attendance	**2**
Test (1x4)	**4**

Record*	**4**
Total	**10**

*****Marks awarded for Record should be related to number of experiments recorded

11.3 Project Evaluation

Components of Project evaluation	**Marks**
Internal Evaluation*	20
Dissertation (end semester)	50
Viva Voce(end Semester)	30

Components of Project Internal evaluation

Components of internal evaluation	Marks
Relevance and Contents	5
Analysis and Presentation	5
Presubmission Presentation and viva	10

*Marks awarded for Record should be related to number of experiments recorded and duly signed by the teacher concerned in charge.

All three components of internal assessments are mandatory.

11.3 For projects

3.a) Marks of external evaluation : 80

3.b) Marks of internal evaluation : 20

Components of External Evaluation of Project	Marks
Dissertation (External)	50
Viva-Voce (External)	30
Total	**80**

*****Marks for dissertation may include study tour report if proposed in the syllabus.

Components of internal Evaluation of Project	Marks
Punctuality	5
Experimentation/data collection	5
Knowledge	5
Report	5
Total	**20**

Attendance Evaluation for all papers

% of attendance	Marks
90 and above	5
85 – 89	4
80-84	3
76-79	2
75	1

(Decimals are to be rounded to the next higher whole number)

13. ASSIGNMENTS

Assignments are to be done from 1st to 6th Semesters. At least one assignment should be done in each semester for all courses.

14. SEMINAR/VIVA

A student shall present a seminar in the 5th semester for each paper and appear for Viva-voce in the 6th semester for each course.

15. INTERNAL ASSESSMENT TEST PAPERS

Two test papers are to be conducted in each semester for each course. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for one year and shall be made available for verification. The responsibility of evaluating the internal assessment is vested on the teacher(s), who teach the course.

15.1 Grievance Redressal Mechanism

Internal assessment shall not be used as a tool for personal or other type of vengeance. A student has all rights to know, how the teacher arrived at the marks. In order to address the grievance of students, a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1: Department Level:

The Department cell chaired by the HOD, Department Coordinator, Faculty Advisor and Teacher in-charge as members.

Level 2: **College level**

A committee with the Principal as Chairman, College Coordinator, HOD of concerned Department and Department Coordinator as members.

The College Council shall nominate a Senior Teacher as coordinator of internal evaluations. This coordinator shall make arrangements for giving awareness of the internal evaluation components to students immediately after commencement of I semester

15.2 The internal evaluation marks/grades in the prescribed format should reach the Controller of Examination before the 4th week of October and March in every academic year.

16. External Examination

The external theory examination of all semesters shall be conducted by the Controller of Examinations at the end of each semester.

16.1 Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the subcommittee of the college council on valid grounds. This condonation shall not be counted for internal assessment. Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also. Those students who are not eligible even with condonation of shortage of attendance shall repeat the **semester** along with the next batch after obtaining readmission upon the recommendations of the head of the department and college council

16.2 All students are to do a **project in the area of core course.** This project can be done individually or in groups (not more than three students). for all subjects which may be carried out in or outside the campus. The projects are to be identified during the V semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the College.

16.3 There shall be supplementary exams only for fifth semester. Notionally registered candidates can also apply for the said supplementary examinations. For reappearance/ improvement for other semesters the students can appear along with the next batch.

16.4 A student who registers his/her name for the external exam for a semester will be eligible for promotion to the next semester.

16.5 A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.

16.6 A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the external examination for the same semester, subsequently. **There shall be no improvement for internal evaluation**.

17. All courses shall have unique alphanumeric code.

18. PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. She/he shall also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.

Pattern of questions Papers

(a) Without practical

Sl. No.	Pattern	Marks	Choice of questions	Total marks
1	Short Answer/problem type	2	10/12	20
2	Short essay/problem	5	6/9	30
3	Essay/problem	15	2/4	30
			Total	80

(b) With practical

Sl. No.	Pattern	Marks	Choice of questions	Total marks

1	**Short Answer/problem type**	**1**	**10/12**	**10**
2	**Short essay/problem**	**5**	**6/9**	**30**
3	**Essay/problem**	**10**	**2/4**	**20**
			Total	**60**

Each BOS shall specify the length of the answers in terms of number of words. Pattern of questions for external examination of practical papers will decided by the concerned Board of Studies/Expert Committees.

19. MARK CUM GRADE CARD

The College shall issue to the students a MARK CUM GRADE CARD on completion of the programme.

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass for a paper. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual papers. If a candidate secures **F Grade** for any one of the paper offered in a Semester/Programme **only F grade** will be awarded for that Semester/Programme until he/she improves this to **D GRADE** or above within the permitted period.

20. There shall **be 2 level monitoring** committees for the successful conduct of the scheme. They are -

1. Department Level Monitoring Committee (DLMC), comprising HOD and two senior- most teachers as members.

2. College Level Monitoring Committee (CLMC), comprising Principal, Secretary Academic Council, College Council secretary and A.A/Superintendent as members.

DEPARTMENT OF ZOOLOGY

UG Programme: MCUSCZO12

B.Sc. Zoology Model I **Total Credits: 120**

Elective: Applied Zoology

Curriculum

	Course Code	Course	Credit	Marks			Weekly Hrs
				Int	Ext	Total	
SEM I	ENG1CMR01	**Common Course**: English 1	4	20	80	100	5
	ENG1CMR02	**Common Course**: English 2	3	20	80	100	4
	ARB1ACMR01/ MAL1ACMR01/ HIN1ACMRR01/ SKT1ACMR01	**CommonCourse**: Additional Language-1 Arabic/Malayalam/Hindi/Sanskrit	4	20	80	100	4
	ZOO1COR01	Core Course-1 Animal Diversity -Part-1	2	15	60	75	2
	ZOO1P01	Core Course-1 Practical Animal Diversity - Part-1	1	-	-	-	2
	CHE1CMP01	Complementary-1 Chemistry-1	2	15	60	75	2
	CHE1CP01	Complementary-1 Chemistry -Practical-1	1	-	-	-	2
	BOT1CMP01	Complementary-2-Botany-1	2	15	60	75	2
	BOT1CP01	Complementary-2- Botany Practical-1	1	-	-	-	2
		TOTAL	**20**	**105**	**420**	**525**	**25**

	Course Code	Course	Credit	Marks			Weekly Hrs
				Int	Ext	Total	
SEM - II	ENG2CMR03	**Common Course**: English 3	4	20	80	100	5
	ENG2CMR04	**Common Course**: English 4	3	20	80	100	4
	ARB2ACMR02 MAL2ACMR02 HIN2ACMR02 SKT2ACMR02	**CommonCourse**: A:dditionalLanguage-2 Arabic/ Malayalam/ Hindi/ Sanskrit	4	20	80	100	4
	ZOO2COR02	Core Course-2 Animal Diversity - Part-1I	2	15	60	75	2
	ZOO2P02	Core Course-2 Practical Animal Diversity -Part-1I	1	10	40	50	2
	CHE2CMP02	Complementary-1 Chemistry-2	2	15	60	75	2
	CHE2CP02	Complementary- 1 Chemistry -Practical-2	1	10	40	50	2
	BOT2CMP02	Complementary-2- Botany-2	2	15	60	75	2
	BOT2CP02	Complementary-2- Botany-Practical-2	1	10	40	50	2
		TOTAL	**20**	**135**	**500**	**725**	**25**

				Int	Ext	Total	
	ENG3CMR05	**Common Course**: English 1	4	20	80	100	4
	ARB3ACMR03/ MAL3ACMR03/ HIN3ACMR03/ SKT3ACM03	**CommonCourse**: AdditionalLanguage-3 Arabic /Malayalam/ Hindi/ Sanskrit	4	20	80	100	4
	ZOO3COR03	Core Course-3 Animal Diversity Vertebrata	2	15	60	75	2
	ZOO3P03	Core Course-3 Practical 3 Animal Diversity - Part -III	1	-	-	-	2
	CHE3CMP03	Complementary-1 Chemistry-3	2	15	60	75	2
	CHE3CP03	Complementary-1 Chemistry - Practical-3	1	-	-	-	2
	BOT3CMP03	Complementary-2- Botany-3	2	15	60	75	2
	BOT3CP03	Complementary-2- Botany-Practical-3	1	-	-	-	2
		TOTAL	**20**	**85**	**340**	**425**	**25**

	Course Code	Course	Credit				Weekly Hrs
				Int	Ext	Total	
SEM IV	*ENG4CMR06*	**Common Course**: English 2	4	20	80	100	5
	ARB4ACMR04/ MAL4ACMR04/ HIN4ACMR04/ SKT4ACMR04	**CommonCourse**: AdditionalLanguage-4 Arabic/ Malayalam/ Hindi/ Sanskrit	4	20	80	100	5
	ZOO4COR04	Core Course-4 Biosystematics and Biodiversity	3	15	60	75	3
	ZOO4P04	Core Course-4 Practical Biosystematics and Biodiversity	1	10	40	50	2
	CHE4CMP04	Complementary-1 Chemistry-4	3	15	60	75	3
	CHE4CP04	Complementary-1 Chemistry - Practical-4	1	10	40	50	2
	BOT4CMP04	Complementary-2- Botany-4	3	15	60	75	3
	BOT4CP04	Complementary-2- Botany Practical-4	1	10	40	50	2
		TOTAL	**20**	**115**	**400**	**575**	**25**

	Course Code	Course	Credit	Marks			Weekly Hrs
				Int	Ext	Total	
SEM V	ZOO5COR05	Core Course-5 Methods and Approaches in Biology	3	15	60	75	3
	ZOO5COR06	Core Course-6 Cell Biology & molecular biology	3	15	60	75	3
	ZOO5COR07	Core Course-7 Environmental Biology & Human rights	3	15	60	75	3
	ZOO5COR08	Core Course-8 Biochemistry, Human Physiology & Endocrinology	3	15	60	75	3
	ZOO5P05	Core Course- Practical 5	1	-	-	-	2
	ZOO5P06	Core Course- Practical 6	1	-	-	-	2
	ZOO5P07	Core Course- Practical 7	1	-	-	-	2
	ZOO5P08	Core Course- Practical 8	1	-	-	-	2
	ZOO5CRE01	Choice based Core Course-1 Applied Zoology Part-1/ Wild life biology/ Vector & Vectorborne Diseases	4	20	80	100	4
		Core ourse Field study, Study tour, group activity	-	-	-	-	1
		TOTAL	**20**	**80**	**320**	**400**	**25**

	Course Code	Course	Credit	Marks			Weekly Hrs
				Int	Ext	Total	
SEM VI	ZOO6COR09	Core Course-9 Reproductive & Developmental Biology	3	15	60	75	3
	ZOO6COR10	Core Course-6 Genetics & Biotechnology	3	15	60	75	3
	ZOO6COR11	Core Course-7 Microbiology & Immunology	3	15	60	75	3
	ZOO6COR12	Core Course-8 Evolution, Zoogeography & Ethology	3	15	60	75	3
	ZOO6P09	Core Course- Practical 5	1	10	40	50	2
	ZOO6P10	Core Course- Practical 6	1	10	40	50	2
	ZOO6P11	Core Course- Practical 7	1	10	40	50	2
	ZOO6P12	Core Course- Practical 8	1	10	40	50	2
	ZOO6CRE02	Choice based Core Course-2 Applied Zoology Part-2/ Pisciculture/ Management of Life style Diseases	3	20	80	100	4
		Core ourse Project Work & Field study, Study tour, Visit to research Institutes, group activity	1	-	-	-	1
		TOTAL	**20**	**120**	**480**	**600**	**25**

PROGRAMME OUTCOMES/ GRADUATE ATTRIBUTES

After successfully completing any three-year under graduate program, a student is expected to achieve the following attributes.

1. **Scientific temper and critical thinking.** Mindset which enables one to follow a way of life that focuses upon the scientific method of understanding reality and the capability to think rationally and reflectively.
2. **Inclusiveness**. Constant exposure to and interaction with disparate social strata for an inclusive mindset, ethical sensibility and greater social sensitivity and empathy.
3. **Democratic practice and secular outlook**. As envisioned by the Constitution of India.
4. **Sense of equality, equity and environment**. Ability to differentiate between pure equality, social equity and a heightened awareness of how humans dialectically interact with environment.
5. **Synergetic work culture**. Capacity to work in groups and the attitude to consider larger goals greater than personal ones.
6. **Emancipatory and transformative ideals**. Attainment of cherished ideals of education for the eventual empowerment of humanity.

Programme specific outcomes of BSc Zoology

1. Understand the biological diversity and grades of complexity of various animal forms through their systematic classification and process of organic evolution.
2. Aquire knowledge on the roles of plants, animals and microbes in the sustainability of the environment and their interaction among themselves and deterioration of the environment due to anthropogenic activities.
3. Develop skills in applied fields of Zoology as Ornamental fish culture, Poultry farms and Dairy farms.
4. Concieve the concepts and principles of Biochemistry, Immunology, Physiology, Ethology, Endocrinology, Developmental biology, cell Biology, Genetics, Molecular Biology and Microbiology and develop technical skills in Biotechnology, Bioinformatics and Biostatistics.
5. Perform laboratory procedures as per standard protocols in the areas of Animal diversity, Systematics, Cell biology, Genetics, Biochemistry, Molecular Biology, Microbiology, Physiology, Immunology, Developmental biology,Environmental Biology, Ethology, Evolution and Science Methodology.

SEMESTER I

ZOO1COR01 Core Course I

ANIMAL DIVERSITY - PART -I

36 Hr **Credit 2**

Objectives

1. To study the scientific classification of invertebrate fauna.
2. To learn the physiological and anatomical features of some invertebrate phyla through type study.
3. To stimulate the curiosity in diverse living organisms around.
4. To Understand the evolutionary significance of various invertebrate fauna.
5. To create an awareness on the habitat of various animals and the need to protect them.

Course outcomes

1. Acquire knowledge on the scientific classification of invertebrate fauna
2. Create an aptitude for understanding nature and its rich biodiversity.
3. Famliarize the students about the protistan fauna living in and around us.
4. Inculcate curiosity to know the animal world along with plants.
5. Study the evolutionary significance of various invertebrate fauna.

Module : I **4 Hrs**

Diversity of life forms – An Overview

Efforts of classification – Two-kingdom, Three Kingdom and Five-kingdom classification (Mention *Cavaller-smith's Eight-kingdom classification also*)

Nomenclature -Uninomial, Binomial & Trinomial

Symmetry – Asymmetry, Spherical, Radial, Biradial and Bilateral

Coelom – Acoelomates, Pseudocoelomates and Eucoelomates Schizocoelom, Enterocoelom, Protostomia and Deuterostomia

Module II: Kingdom Protista **15Hrs**

Type: - Paramecium

Salient features and classification upto Phyla.

(*Mention the names of phyla of animal-like, plant-like and fungus-like protists)*

Animal-like protists

Salient features of animal-like protists with notes, on the examples cited.

1. Phylum Rhizopoda : *Amoeba.*
2. Phylum Actinopoda : *Actinophrys.*
3. Phylum Foraminifera: *Elphidium.*
4. Phylum Ciliophora : *Paramecium.*
5. Phylum Opalinata: *Opalina* .
6. Phylum Kinetoplasta : *Trypanosoma.*
7. Phylum Metamonada : *Giardia.*
8. Phylum Choanoflagellata : *Proterospongia.*
9. Phylum Parabasilia : *Trychonympha.*
10. Phylum Sporozoa : *Plasmodium.*

Plant-like protists

(*Mention any five general characters for each phylum. Detailed accounts of examples are not necessary*)

11. Phylum Euglenophyta : *Euglena.*
12. Phylum Cryptophyta : *Cryptomonas.*
13. Phylum Bacillariophyta : Diatoms
14. Phylum Chlorophyta : *Volvox.*
15. Phylum Rhodophyta : Red Algae
16. Phylum Dinoflagellata : *Noctiluca.*

Fungus-like protists

(*Mention any five general characters for each phylum. Detailed accounts of examples are not necessary*)

16. Phylum Myxomycophyta : Slime moulds
17. Phylum Microsporidia : *Nosema* .

General topics: (1) Parasitic Protists (Entamoeba ,Leishmania, Trypanosoma)

(2) Lifecycle of Plasmodium

(Mention different species of Plasmodium: *P.vivax, P.malariae, P.falciparum, P.knowlesi, and P.ordi*)

Module III

Kingdom Animalia

Outline classification of Kingdom Animalia **1Hr**

Three sub kingdoms – **Mesozoa, Parazoa and Eumetazoa**

Sub kingdom **Mesozoa: Phylum Orthonectida -** E.g. *Rhopalura*

Sub kingdom **Parazoa:** **3Hrs**

1. Phylum Placozoa – Eg. *Trycoplax adherens*

2. Phylum Porifera –

Salient features and classification upto classes; Mention Gemmules

Class I – Calcarea E.g. *Sycon.*

Class II – Hexactinellida E.g. *Euplectella*.

Class III – Demospongia E.g. *Cliona*.

General topics

1. Canal system in Sponges.

Sub kingdom: Eumetazoa

Phylum Coelenterata

Type- Obelia **4Hrs**

Salient features and classification upto classes

Class I- Hydrozoa Eg. *Physalia*

Class II- Scyphozoa Eg. *Rhizostoma.*

Class III- Anthozoa Eg. *Fungia*

General topics

1. Coral and coral reefs.
2. Polymorphism in Coelenterates.

Phylum Ctenophora **1 Hr**

Salient features

E.g. *Pleurobrachia*

MODULE IV:Phylum Platyhelminthes 3Hrs

Salient features and classification upto classes

Class I- Turbellaria E.g. *Dugesia.*

Class II- Trematoda E.g. *Fasciola*

Class III- Cestoda E.g. Taenia solium

General topics

1. Life history of *Fasciola hepatica.*
2. Platyhelminth parasites of Man and Dog *(Schistosoma, Taenia solium, Echinococcus*).

MODULE V: Super phylum : Aschelminthes 2Hrs

Phylum Nematoda

Salient features and classification upto classes

Class- Phasmidia E.g. *Enterobius, Ascaris.*

Class -Aphasmidia E.g. *Trichinella.*

General topic

Pathogenic nematodes in man.(*Wuchereria bancrofti (Lifecycle), Brugia malayi , Ancylostoma duodenale, Enterobius vermicularis , Ascaris lumbricoides)*

Module VI: Phylum Annelida 2Hrs

Salient features and classification upto classes

Class I- Archiannelida E.g. *Polygordius.*

Class II- Polychaeta E.g. *Neanthes.*

Class III- Oligochaeta E.g. *Pheretima.*

Class IV- Hirudinomorpha E.g. *Hirudinaria.*

Phylum Onychophora 1 Hrs

Distribution, peculiarities and affinities

E.g. *Peripatus*.

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Thomas A. P. (Editor) 2009. , Invertebrata , Greenleaf Publications, Kottayam.

Dhami P. S. and Dhami J. K,1979. Invertebrate Zoology. R. Chand and Co. Delhi.

Ekambaranatha Ayyar M. 1990. A Manual of Zoology, Volume I, Invertebrates Part I and Part II. S. Viswanathan Printers and Publishers Pvt. Ltd.

Parker & Haswell, Text book of zoology-Invertebrate ,volume 1, 7 th edition

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SEMESTER I
PROGRAMME: B.Sc. Zoology
CORE COURSE: COURSE CODE: ZOOICOR01
COURSE TITLE: ANIMAL DIVERSITY PART-I

Module	**Hrs Alloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	4	2	1	1	4
2	15	4	4	2	10
3	9	3	2	1	6
4	3	1	1	-	2
5	2	1	-	-	1
6	3	1	1	-	2
Total	36	12	9	4	25

SEMESTER I B.Sc. ZOOLOGY

ZOO1COR01 ANIMAL DIVERSITY - PART-I

Time: 3 Hours **Max. Marks: 60**

PART – A

Answer any 10 questions. Each question carries 1 mark.

1. Mention Trinomial nomenclature.
2. What are choanocytes?
3. Differentiate between polyp and medusa.
4. What is a digenetic parasite? Give an example.
5. Write down the phylum under which the following comes.
    a. Elphidium b.Volvox
6. What is meant by metagenesis?
7. Mention cnidocytes.
8. Define radial symmetry. Give an example.
9. What is Venus' flower basket ?
10. Name the class under which Dugesia comes.
11. What are Gemmules in Sponges.
12. Write down the parasitic adaptations of Ascaris. **(10x1=10marks)**

PART- B

Answer any 6 questions. Each question carries 5 marks

13. Classify phylum Annelida with examples.
14. Briefly explain symmetry in animal with examples.
15. Mention the salient features of phylum Platyhelminthes.
16. Describe polymorphism in Coelenterate.
17. Explain canal system in Sponges.
18. Discuss the peculiarities and affinities of Peripatus.
19. Briefly explain life history and pathogenesity of *Wuchereriabancrofti*.
20. Distinguish between Protostomia and Deuterostomia.
21. Describe the features of Noctiluca. **(6 x 5 = 30 marks)**

PART- C

Answer any 2 questions choosing one from each bunch. Each question carries 10 marks

22. Explain the life history of *Fasciola hepatica*.
23. Write an essay on Polymorphism in Coelenterates.
24. Explain the life cycle of Plasmodium.
25. Describe the morphology, life history and pathogenicity of the following.
    a. *Taeniasolium* b. *Schistosomahaematobium*. **(2 x 10 = 20 marks)**

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SEMESTER I **ZOO1P01 PRACTICAL**

ANIMAL DIVERSITY- PART -I

36 Hours **Credit 1**

Scientific Drawing:-

Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla up to Annelida.

Anatomy:-

Study of sections. (Any two)

1. *Hydra*. 2. *Ascaris* 3. Earthworm 4. *Fasciola.*

Dissections/Virtual Dissection

1. Earthworm - Alimentary canal upto 26 th segment

2. Earthworm - Nervous system

Mounting:-

1. *Nereis* - Parapodia

2. Earthworm - Setae

3. Earthworm – Spermatheca

Identification:-General identification- The students are expected to identify the animals by their generic names and 20% of these by their specific names. Protista , Porifera, Coelenterata, Platyhelminthes, Annelida (15 specimens)

SEMESTER II

ZOO2COR02-Core Course II
ANIMAL DIVERSITY - PART II

36 Hrs **Credits 2**

Objectives:

1. To study the scientific classification of fauna.
2. To learn the physiological and anatomical features of various phyla through type study.
3. To stimulate the curiosity in living things.
4. To learn the evolutionary significance of various fauna.
5. To have an understanding on the need to protect local fauna.

Course outcomes

1. Create appreciation on diversity of life on earth.
2. Understand different levels of biological diversity through the systematic classification of invertebrate fauna & familiarize taxa level identification of animals
3. Master thorough knowledge on the physiological and anatomical features of some invertebrate phyla through type study.
4. Understand the evolutionary significance of invertebrate fauna
5. Acquire knowledge on parasitic forms.

Module I : Phylum Arthropoda **11 Hrs**

Salient features and Classification upto classes

Type :-Penaeus

1. Subphylum: Trilobitomorpha

Class – *Trilobita* (Mention salient features)

Eg.*Triarthrus* – A trilobite (extinct)

2. Subphylum: Mandibulata

Class I –	Crustacea	E.g. *Sacculina*
Class II –	Chilopoda	E.g. *Scolopendra* (Centipede)
Class III –	Symphyla	E.g. *Scutigerella*
Class IV –	Diplopoda	E.g. *Julus* (Millipede)
Class V –	Insecta	E.g. *Periplaneta* (Cockroach)
Class VI –	Pauropoda	E.g. *Pauropus*

3. Subphylum Chelicerata

Class I – Merostomata E.g. *Limulus*
Class II – Arachnida E.g. *Scorpion*

General topics

1. Arthropod Vectors -Mosquitoes, Sand flies, Flea,Ticks
2. Larval forms of *Penaeus*

Module II **4hrs**

Phylum Mollusca

Salient features and Classification upto classes

Class I Monoplacophora E.g. *Neopilina*
Class II Amphineura E.g. *Chiton*
Class III Gastropoda E.g. *Pila*
Class IV Scaphopoda E.g. *Dentalium*
Class V Pelecypoda E.g. *Pinctada*
Class VI Cephalopoda E.g. *Sepia*

General topics

Pearl culture

Phylum Echinodermata **6Hrs**

Salient features and Classification upto classes

Class I Asteroidea E.g. *Astropecten*
Class II Ophiuroidea E.g. *Ophiothrix*
Class III Echinoidea E.g. *Echinus*
Class IV Holothuroidea E.g. *Holothuria*
Class V Crinoidea E.g. *Antedon*

General topics

Water vascular system
Larval forms of echinoderms

Minor phyla **2Hrs**

Salient features

1. Chaetognatha E.g. *Sagitta*
2. Sipunculida E.g. *Sipunculus*
3. Rotifera E.g. *Brachionus* (Examples in brief **)**

Phylum Hemichordata

Salient features **1Hr**

Eg. *Balanoglossus* – Affinities & Significance.

Module III **12Hrs**

Phylum Chordata

Salient features and classification

Classification up to order (Sub phylum, Super class, Class, Sub class, Order)

Protochordates : General characters and Classification

Sub Phylum: Urochordata

Salient features

Class I Larvacea E.g. *Oikopleura.*

Class II Ascidiacea E.g. *Ascidia* (Mention retrogressive metamorphosis)

Class III Thaliacea E.g. *Doliolum*

Sub phylum: Cephalochordata

Salient features

Type *: Amphioxus*.

References :

Barnes,R.D (1982) Invertebrate Zoology ,V th Edition

Ekabaranatha Ayyar M. 1990. A Manual of Zoology. Volume 1. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

Ekabaranatha Ayyar M. 2000. A Manual of Zoology. Volume 2. S. Viswanathan Printers & Publishers. Pvt. Ltd.

Young J.Z, 1981, The life of Vertebrates. Oxford university press.

Young J.Z, 2006, The life of Vertebrates. Oxford university press(Third Ed.) India Ed.

Zoological Society of Kerala Study material. *Animal Diversity* 2002 & 2010.

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SEMESTER II

PROGRAMME: B.Sc. ZOOLOGY

CORE COURSE: 2 COURSE CODE: *ZOO2COR02*

COURSE TITLE: ANIMAL DIVERSITY - PART II

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	11	3	3	1	7
2	13	5	3	2	10
3	12	4	3	1	8
Total	36	12	9	4	25

B.Sc. DEGREE (CBCS) EXAMINATION

SEMESTER- IIB.Sc. ZOOLOGY

ZOO2COR02 ANIMAL DIVERSITY - PART II

Time: 3 Hours **Max. Marks: 60**

PART – A

Answer any 10 questions. Each question carries 1 mark.

1. Sexual dimorphism in *Penaeus.*
2. Pectines.
3. Nauplius.
4. What is Scaphognathite?
5. Tube feet.
6. What is Ink sac?
7. Respiratory trees?
8. Tiedemann's bodies.
9. Notes on Arrow worms.
10. Wheel organ.
11. Distinguish between *Scolopendra* and *Julus*
12. Parasitic adaptations of *Sacculina* **(10x1=10marks)**

PART- B

Answer any 6 questions. Each question carries 5 marks

13. Give the branchial formula of *Penaeus*.
14. Describe the reproductive system of *Penaeus.*
15. Describe any two vectorial arthropods.
16. Write notes on sensory organs of *Penaeus*
17. Salient features of Phylum Echinodermata**.**
18. Describe the water vascular system of starfish.
19. Explain the digestive system of Amphioxus.
20. Retrogressive metamorphosis in Ascidia.
21. Describe briefly any two larval forms of Echinodermata **(6 x 5 = 30 marks)**

PART- C

Answer any 2 questions . Each question carries 10 marks

22. With the help of labelled diagram, describe the appendages of *Penaeus*.
23. Give a detailed account of the larval forms of *Penaeus*
24. Describe the morphology of Amphioxus. Add notes on its systematic position.
25. Write an essay on pearl culture. **(2 x 10 = 20 marks)**

SEMESTER II

ZOO2P02 PRACTICAL

ANIMAL DIVERSITY- PART II

36 hrs. **Credit 1**

Scientific Drawing:- Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla (Arthropoda to Hemichordata)

Anatomy: - Study of sections.

1. Amphioxus - T.S through pharynx and T.S through intestine

Dissections /Virtual dissection

1. Cockroach - Nervous system
2. Prawn- Nervous System

Mounting:-

1. Prawn -Appendages
2. Honey bee/plant bug/Mosquito (any two) -Mouth parts
3. Cockroach -Salivary glands

Identification:-General identification- The students are expected to identify the following animals by their generic names and 20% of these by their specific names. (Arthropoda, Mollusca Echinodermata, Hemichordata and Protochodata) (15 specimens)

Taxonomic identification with key:- Identification of insects up to the level of order. (5 Specimens) Odonata, Coleoptera, Diptera Hymenoptera, Lepidoptera.

SEMESTER III

ZOO3COR03 CORE COURSE III

ANIMAL DIVERSITY – PART-III

54 Hrs **Credits 3**

Objectives:

1. To make the student observe the diversity in chordates and their systematic position.
2. To appreciate the diversity of life forms
3. To inculcate the sense of scientific enquiry on biodiversity related topics.
4. To have a knowledge on minor phyla.
5. To know the organization of internal organs in different phyla.

Course outcomes

1.Understand the diversity among vertebrates and the relationship among the different groups
2. Classify vertebrates to their respective classes based on their concepts
3. Able to follow the evolutionary pathway of vertebrates
4. Inculcate the sense of scientific enquiry on faunal diversity.
5. Acquire skills to identify an animal.

Module I **8 Hrs**

Sub phylum: Vertebrata

Division 1 - Agnatha

Class I Ostracodermi Eg: *Cephalaspis*

Class II Cyclostomata Eg: *Petromyzon*

Division 2_ Gnathostomata

Super Class : Pisces

Salient features and classification

Class: Chondrichthyes

Sub class - Elasmobranchi Eg.*Narcine*

Sub Class- Holocephali Eg: *Chimaera*

Class: Osteichthyes

Sub Class – Choanichthyes

Order1- Crossopterigii Eg: *Latimeria*

Order 2: Dipnoi Eg: *Lepidosiren, Protopterus and Neoceratodus*.

Sub Class – Actinopterigii

Super Order 1- Chondrostei Eg: Acipencer
Super Order 2- Holostei Eg- *Amia*
Super order 3- Teleostei Eg: *Sardine*

General topics

1. Accessory respiratory organs in fish
2. Parental care in fishes.
3. Migration in fishes.

Module II **10 hrs**

Super Class Tetrapoda

Class : **Amphibia**

Salient features and classification

Frog- (*Euphlyctis hexadactylus)* **Type**

Order I Anura Eg: Hyla (*Haplobatrachus tigrinis)*

Order II Urodela Eg: *Amblystoma* (Mention axolotl larva and neoteny – paedomorphosis)

Order III Apoda Eg: *Ichthyophis.*

General Topics

Parental care in amphibians

Module III **8 Hrs**

Class : Reptilia

Salient features and classification

Sub Class I : **Anapsida**

Order : Chelonia Eg: *Chelone*

Sub Class II : **Parapsida** Eg: *Ichthyosaurus*

Sub Class III : **Diapsida**

Order : Rhynchocephalia Eg : *Sphenodon* (characters and affinities)

Order : Squamata - Characters

Suborder Lacertilia Ex;.*Chamaeleon, Draco.*

Suborder Ophidia Ex : Cobra, Viper, Rat snake.

Suborder Crocodilia ex: *Crocodilus, Alligator.*

Sub Class IV : **Synapsida** Eg: *Cynognathus.*

General topics

Identification of poisonous and non- poisonous snakes.

Common Poisonous & Non Poisonous Snakes of Kerala.

Snake venom, poison apparatus.

Module IV **10 Hrs**

Class Aves

Salient features and classification

Sub Class I : Archeornithes E.g. *Archeopteryx*

Sub Class II : Neornithes

Super Order I Palaeognathae Eg: *Struthio*

Super Order I Neognathae Eg: *Pavo cristatus*

Type: Pigeon (Columba livia)

General topics

1. Migrations in birds
2. Flight adaptations in birds.
3. Common birds of Kerala (brief account)

Module V **18Hrs**

Class : Mammalia

Salient features and classification

Type : Rabbit

Sub Class I : Prototheria Eg: *Echidna, Platypus*

Sub Class II: Theria

Infraclass : Metatheria Eg : *Macropus*

Infraclass : Eutheria

Order 1 Insectivora E.g. *Talpa*

Order 2 Dermoptera E.g. *Galeopithecus*

Order 3 Chiroptera E.g. *Pteropus*

Order 4 Primates E.g. *Loris*

Order 5 Carnivora E.g. *Panthera*

Order 6 Xenarthra/ Edentata E.g. *Armadillo*

Order 7 Pholidota E.g. *Manis*

Order 8 Proboscidae E.g. *Elephas*

Order 9 Hyracoidea E.g. *Procavia*

Order 10 Sirenia E.g. *Dugong*

Order 11 Perissodactyla E.g. *Zebra*

Order 12 : Artiodactyla E.g. *Camelus*

Order 13 : Lagomorpha E.g. *Oryctolagus*

Order 14 : Rodentia E.g . *Hystrix*

Order 15 : Tubulidentata E.g. *Orycteropus*

Order 16 : Cetacea E.g. *Delphinus*

General topics

1. Dentition in mammals.
2. Aquatic Mammals and their adaptations.
3. Endangered Mammals of Kerala (brief Account).

Core readings

Ekambaranatha Iyer 2000 A Manual of Zoology Vol. !!.S. Viswanathan and Co.

Jhingran 1977, Fish and Fisheries of India, Hindustan Publishing Co.

Jordan E L and .P.S. Verma, 2002 Chordate Zoology S. Chand and Co. New Delhi.

Kotpal R.L. 2000, Modern Text Book of zoology, Vertebrates, Rastogi Publications, Meerut.

Nigam and Sobti 2000, Functional Organization of Chordates. Shoban Lal Nagin Chand and Co. New Delhi.

Young J.Z, 1981, The Life of Vertebrates Oxford University Press.

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Thomas A P (Editor) 2010 Chordata.

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SEMESTER V

PROGRAMME: B.Sc. ZOOLOGY

SEMESTER III

ZOO3COR03 CORE COURSE III

ANIMAL DIVERSITY – PART-III

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	8	2	2	1	5
2	10	2	2	-	4
3	8	2	2	1	5
4	10	3	1	1	5
5	18	3	2	1	6
Total	54	12	9	4	25

MODEL QUESTION PAPER

SEMESTER –III

ZOO3COR03 CORE COURSE III

ANIMAL DIVERSITY – PART-III

Time : 3 Hours **Max.marks: 60**

PART A

Answer any 10 questions. Each question carries one mark

1. Electric Organ.

2. Amphicoleous Vertebra.

3. Scientific name of Flying Frog.

4.Jacobson's Organ.

5.Hardarian gland.

6.Synscarum.

7. Scientific name of National Bird on India.

8. Lateral line organ.

9. Diapsid skull.

10.Coprophagy.

11.Chiroptera.

12.Macropus. **(10x1= 10marks)**

PART B

Answer any 6 questions. Each question carries 5 marks.

13. Give a detailed account of the evolutionary significance of *Archaeopteryx*.

14. Describe the adaptations of *Chameleon.*

15. Explain the different types of Skull in Reptiles.

16. Explain Neoteny with *Amblystoma* as example

17. Describe the Respiratory system of *Euphlyctishexadactylus*

18. Differentiate Chondrichthyes from Osteichythes with suitable examples.

19.Define Living Fossils and explain the evolutionary significance.

20.Give an account of infraclass metatheria with an example.

21.Explain the digestive system and digestion of Rabbit. (**6x5=30marks)**

PART C

Answer any 2 questions. Each question carries 10marks

22. Give an account on the common Snakes of Kerala.

23. Describe the Aquatic Mammals and their adaptations.

24. Explain the Accessory respiratory organs in fishes.

25.Give a detailed account on the Volant adaptations of birds. **(2 x 10= 20 marks)**

SEMESTER III

ZOO3P03 CORE PRACTICAL

ANIMAL DIVERSITY – PART - III

36hrs **Credit 1**

1. Morphology: Scientific Drawing

Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes

2. Dissections/Virtual Dissection

Frog: Photographs/diagrams/one dissected & preserved specimen each/models may be used for study.

1. Frog Viscera

2. Frog Digestive System

3. Frog Arterial System

4. Frog 9^{th} & 1^{st} Spinal nerve

5. Frog Sciatic Plexus

6. Frog Brain/Shark brain

Mounting of placoid scales/cycloid/ctenoid scales

3. Osteology

Frog vertebrae

Pectoral and pelvic girdles of Frog

Turtle - plastron and carapace

Vertebrae & Synsacrum of Bird

Skull of Rabbit (Diastema –dentition)

Pectoral and pelvic girdles of Rabbit.

4. Identification:-

General identification-

Identify the animals by their generic names and 25 % of them by their specific names.

(Pisces-5, Amphibia-3, Reptilia- 4, Aves-1,Mammalia-2)

5. Taxonomic identification with key:-

i) Identification of fishes up to the level of order.
ii) Identification of snakes up to family

SEMESTER IV

ZOO4COR04 CORE COURSE IV

BIOSYSTEMATICS AND BIODIVERSITY

54 hrs Credits 2

Objectives:

1. To create appreciation on diversity of life on earth
2. To understand different levels of biological diversity
3. To familiarize taxa level identification of animals
4. To learn biodiversity estimation techniques
5. To create interest for conservation of biodiversity

Course outcomes:

1. Understand the appreciate the biodiversity in our earth
2. Equip to evaluate the current environmental issues in a wider perspective
3. Understanding the quantum of biodiversity in local level and can evaluate the impact of anthropogenic activity on it
4. Estimation of biodiversity in economic terms
5. Able to raise the concern on environmental issues without fear

UNIT IBIOSYSTEMATICS 18 hrs

Module I 9 hrs

Taxonomy and Biosystematics, Taxonomical Principles , Brief history

Concepts and definition, Importance of classification

Approaches of taxonomy. Molecular taxonomy

Phylogeny and Taxonomy, Tree of Life, bar coding of life Zoological nomenclature

International Code of Zoological Nomenclature (ICZN) – Rules.

Module II **5 hrs**

Tools and techniques

Identification Keys, Single access key -Dichotomous keys, Polytomous key,

Multi access key, Advantages and disadvantages

Module III

Animal Collection techniques **4 hrs**

Collection methods, techniques and equipments- Plankton, Insects, Fish, Bird

Preservation techniques - Curation, Taxidermy

Rearing techniques , Laboratory and field.

UNIT II: BIODIVERSITY **10 hrs**

Module IV **3hrs**

Introduction -Definition, Alpha, Beta, and Gamma diversity, Scope and importance of biodiversity

Levels of biodiversity,Genetic, Species, Microbial and agro ecosystem

Distribution of Biodiversity on earth- Tropical, temperate and polar, Biodiversity hot spot

India as a mega biodiversity nation

Module V **2 hrs**

Values of biodiversity: Direct use value, indirect use value, Non-use value, Ecosystem services

Module VI

Threats to biodiversity **5 hrs**

Types of threats : Habitat loss, Invasive species, Pollution, Anthropogenic activities Climate change

Human - wildlife conflict (with case studies)

Module VII **14 hrs**

Biodiversity conservation and management Conservation strategies

In situ, ex situ,National parks, Sanctuaries and Biosphere reserves

International efforts -CITES, Convention on Biological Diversity (CBD)

IUCN-Mention status, Red and Green Data Book,

WCMC, UNEP, NBA, SBB, DMC

Conservation strategies in India, MoEF

Legal measures: Wild life Protection Act, 1972, The Environment Protection Act, 1986

Forest (Conservation) Act1980, 1988 , Biodiversity Act 2002 ,Biodiversity rule 2004

National biodiversity action plan ,People's participation, Peoples biodiversity register (PBR)

Local initiatives (Chipko movement, Narmada bachavo Andolan, Silent Valley Movement)

Module VIII **5 hrs**

Biodiversity estimation

Tools and techniques

Sampling techniques – Quadrate, Line transect

Measurements - Density, Abundance, Frequency

Biodiversity indices -Concepts

Shannon-Weiner, Simpson

Module IX **7Hrs**

Bioethics

Introduction

Animal rights and animal laws in India.

Prevention of cruelty to animals Act 1960

Concept of 3 R - (Refine- to minimize suffering, Reduce -to minimize animals, Replace – modern tools and alternate means)

Animal protection initiatives-Animal Welfare Board, CPCSEA

Human Rights Act-1995, 1998.

REFERENCES

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Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.

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SEMESTER IV

PROGRAMME: B.Sc. ZOOLOGY

CORE COURSE: IV ZOO4COR04

BIOSYSTEMATICS AND BIODIVERSITY

Module	**Hrs Alloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	9	1	1	1	3
2	5	2	1		3
3	4	3	1		4
4	3	1	1		2
5	2		1		1
6	5			1	1
7	14	1	3	1	5
8	5	2	1		3
9	7	2		1	3
Total	54	12	9	4	25

B.Sc ZOOLOGY PROGRAMME
ZOO4COR04 CORE COURSE IV
BIOSYSTEMATICS AND BIODIVERSITY

Time 3 hours **Maximum Mark 60**

PART A

Answer any 10 questions . Each question carries 1 mark

1. Comment on molecular taxonomy.
2. What is single access key?
3. Significance of identification keys.
4. What is Taxidermy?
5. Any two preservation methods of fishes.
6. Comment on plankton net.
7. Notes on biodiversity hotspots.
8. What is In situ conservation?
9. Define abundance.
10. What is quadrate sampling?
11. Comment on CPCSEA.
12. Explain the concept of refine in bioethics. **(10x1=10 marks)**

PART B

Answer any 6 questions. Each question carries 5 marks

13. International Code of Zoological nomenclature.
14. Mention multi-access key. Add a note on its advantages and disadvantages.
15. Briefly describe various rearing techniques.
16. India is one of the mega diversity country in the world . Substantiate .
17. Give a short account on value aspects of biodiversity.
18. Write down the significances and provisions of Biodiversity Act 2002.
19. Write a brief account on international efforts to conserve biodiversity.
20. Evaluate the impact of Indian Wild life Act 1972 in the field of biodiversity

Conservation.

21. Explain the concept of any one biodiversity indices. **(6x5= 30 marks)**

PART C

Answer any 2 questions .Each question carries 10 marks

22. Explain the concept of taxonomy.

23. Describe various threats to Biodiversity .

24. Give a detailed account on various conservation strategies . Add a note on any two international efforts to conserve biodiversity.

25. Write an essay on bioethics. **(2x10=20marks)**

SEMESTER IV

ZOO4P04 CORE PRACTICAL

BIO SYSTEMATICS AND BIODIVERSITY

36 Hrs **Credit 1**

1. Quadrate study

2. Transect study

3. Sampling

4. Species area curve

5. Identification using keys- Insect, Fish & Snake

6. Taxa, identification techniques

    Bird body parts

    Butterfly/ dragonfly body parts and venation

7. Identification of local biodiversity representing different taxa(Submit a report)

8. Field study (compulsory)

    Visit to two important areas of biodiversity

    (Report should be submitted by each student)

SEMESTER **V**

ZOO5COR05 CORE COURSE V
METHODS AND APPROACHES IN BIOLOGY

54 hrs

Credit 3

Objectives

1. To develop proper scientific mind, understand some basic concept of research in biology and its methodologies
2. To gain an understanding of tools and techniques used for data collection in biology
3. Student will learn how to choose and apply statistical tools to data sources, when and how statistical tools can be used to analyze data.
4. To have an experience in using computer technology in the application of statistical procedures.
5. To gain a theoretical as well as hands on experience with common bioinformatics tools and databases.

Course outcomes

1. Inspire the students in learning the frontier areas of biological sciences, update and expand basic informatics skills and attitudes relevant to the emerging knowledge of society.
2. Equip the students to effectively utilize the digital knowledge resources in learning and to understand the scope and role of statistics; methods and procedures of sampling; Construction of tables, charts and graphs.
3. Familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences.
4. Familiarize the basic concept of scientific method in research process and on various research designs and to apply statistical methods in biological studies..
5. Will develop skill in research communication and scientific documentation.

UNIT 1 : R E S E A R C H METHODOLOGY — 18 hrs

Module1 — **6 hrs**

- Research- Types of Research.
- Process of Research-Steps,Importance of literature review.
- ResearchCommunication
- Research report writing (Structure of a scientificpaper)

- Project proposal writing.
- Presentation techniques: Oral presentation, Assignment, Seminar, Debate, Workshop, Colloquium, Conference. Brief description and major differences
- Ethical issues in Biological research, Plagiarism
- Role of IPR in Research and Development.

UNIT2 TOOLS & TECHNIQUES IN BIOLOGY 12 hrs

Module 2

- Microscopes –Light microscopes ,dark- field, fluorescent, Phase-contrast,Electron microscopes-TEM and SEM, STEM ,Video microscopy.
- Colorimeter, Spectrophotometer, pH meter, Chromatography, Electrophoresis,Centrifuge , Camera Lucida, Micrometry, X-ray crystallography

Units of Measurements-concentrations- percent volume; ppt; ppm Chemical – molarity, normality

UNIT3 BIOSTATISTICS 18 Hrs

Module 3

- Collection of data, Sample & Population, Sampling techniques, Classification of data, frequency distribution tables.
- Data presentation –tables, Diagram (Bar diagram ,Pie diagram , pictogram)graphs(line graphs, Histogram, frequency curve ,frequen cypolygon, ogives)
- Measures of central tendency- Mean, Median, Mode, (merits & demerits)
- Measures of Dispersion- Mean deviation , Standard deviation, Range ,Standard error (merits &demerits
- Correlation –Definition ,Types ofcorrelation
- Statistical tests-Basic concepts ,test of significance ,procedure for testinghypothesis.t test, chi square ,ANOVA(Basic conceptsonly)
- Statistical inference-Probability distribution(Binomial, Poisson distribution,Normal distribution) -brief descriptiononly
- Statistical packages.

UNIT4 BIOINFORMATICS 18 hrs

Module 4 8 Hrs

- Definition, Contrast between Bioinformatics and computational biology
- Basic concepts in Bioinformatics, importance and role of bioinformaticsin life sciences
- Biological databases -Nucleotide sequence databases- NCBI- GENBANK. DDBJ & EMBL-ENA
- Protein databases- structure and sequence databases- PDB, SWISSPROT & UNIPROT.
- Introduction to Sequence alignments: Local alignment and Global alignment, Pair wise alignment and multiple sequence alignment.

Module 5 **6hrs**

- FASTA sequence file formats.
- The BLAST search engine- Important features
- Molecular Phylogeny, Phylogenetic Tree construction and Analysis
- Proteomics: Basic ideas of Protein Structure prediction- Concept of Homology Modeling

Module 6 : Bioinformatics tools: **4 Hrs**

- Molecular visualization software-RASMOL
- ORF Finding Tool
- Single Nucleotide Polymorphism
- Basic concepts of Drug discovery pipe line, computer aided drug discovery and its applications. Human Genome Project, Human Brain Project

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Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.
Rastogiet. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

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Rashidi, Hooman H. and Buehler, Lukas K. [2001].*Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.\
Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.

Zoological Society of Kerala Study Material 2002 – *Cell Biology, Genetics & Biotechnology*.

Chapter- 2 Tools and Techniques.

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SEMESTER V

PROGRAMME: B.Sc. Zoology

CORE COURSE: V COURSE CODE: ZOO5COR05

COURSE TITLE: METHODS AND APPROACHES IN BIOLOGY

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	6	1	1	1	2
2	12	3	2	1	5
3	18	4	3	1	2
4	12	3	2	1	2
5	6	1	1	-	2
Total	**54**	**12**	**9**	**4**	**25**

B.Sc. DEGREE (CBCS) EXAMINATION
SEMESTER- V B.Sc. ZOOLOGY
ZOO5COR05 METHODS AND APPROACHES IN BIOLOGY

Time: 3hrs **Max.** Marks 60

Part A

Answer any 10 questions. Each carries 1 mark

1. What is Plagiarism
2. Define the term "proteome "
3. Define standard error.
4. What are ogives?
5. What do you mean by BLAST?
6. Write short notes on FASTA sequences.
7. Write short notes on Beer- Lambert's law
8. Define correlation.
9. What is SNP?
10. Give the principle of chromatography
11. Write short notes on micrometry.
12. What is ANOVA? **(10x1=10 marks)**

Part B

Answer any 6 questions. Each carries 5 marks

13. Write about the working and principle of Phase-contrast microscope.
14. Briefly explain types of research.
15. Write notes on RASMOL.
16. Differentiate between pair-wise and multiple sequence alignment and describe their use in phylogenetic analysis.
17. Explain the procedure involved in test of hypothesis.
18. Calculate the median

x	12	9	8	10	11	13	7
f	14	8	6	9	11	12	3

19. Explain BLAST program and list its variants.
20. Explain the principle and types of electrophoresis.
21. Find out the standard deviation of the following data

Length of the fish in mm	67	69	66	68	72	63	76	65	70	74

(6x5=30 marks)

Part C

Answer any 2 questions choosing one from each bunch. Each carries 10 marks

22. Write an essay on electron microscopy.

23. Explain in detail the databases used in bioinformatics.

24. What do you mean by probability? Explain different distributions.

25. Write an essay on different presentation techniques.

(2x10=20 marks)

SEMESTER **V**

ZOO5PO5 PRACTICAL V

METHODS AND APPROACHES IN BIOLOGY

36hrs **Credit 1**

1. Micrometry- Calibration and measurement of microscopic objects
2. Make illustration using Camera lucida- Mention scale used
3. Paper Chromatography (Demonstration only)
4. Graphical representation of biological data using Histograms, Line graphs and Pie diagrams
5. Find arithmetic mean, median, mode and range of a given data
6. Standard deviation of a biological data
7. Apply appropriate statistical test to solve the problem (Instructor can choose problems involving, t-test / chi square) using statistical packages.
8. Download a specified sequence from NCBI and search it with BLAST and report result with comments.
9. Download any protein sequence from PDB database and visualize it using RASMOL and comment on it
10. Download 2 sample DNA sequences and find SNPs in it.

SEMESTER V ZOO5COR06 CORE COURSE VI

CELL BIOLOGY AND MOLECULAR BIOLOGY

54 Hrs **Credits 3**

Objectives:

1. To emphasize the central role of Cell biology and Molecular biology, being the rapidly developing areas of biological science.
2. To make aware of different cell organelles, their structure and role in living organisms.
3. To introduce the nature of genetic materials at molecular level, their expression and regulation.
4. To develop critical thinking, skill and research aptitudes.
5. To know the process of cell division and learn how growth & reproduction occurs.

Course Outcomes

1. Understand the central role of Cell biology and Molecular biology, being the rapidly developing areas of biological science.
2. Acquire knowledge on different cell organelles, their structure and role in living organisms.
3. Learn the nature of genetic materials at molecular level, their expression and regulation.
4. Motivate the learner to critical thinking, skill and research aptitudes.
5. Understand cell division as a key for growth & reproduction.

UNIT 1 - CELL BIOLOGY **29 Hrs**

Module I Introduction to cell and molecular biology (2 hrs)

Cell theory, Prokaryotic and Eukaryotic cells, Actinomycetes, Mycoplasmas, Viruses, Virions and Viroids, Prions.

Module II Cell membrane & Permeability (6 hrs)

Molecular models of cell membrane

(Sandwich model, Unit membrane model, Fluid mosaic model)

Modifications of plasma membrane. (Microvilli, tight junction, gap junction, desmosomes)

Cell permeability - Passive transport, Diffusion, Osmosis, Active transport, Cell coat and Cell recognition.

Module III Ultrastructure of Cytoplasm (7 hrs)

Organization and functions of the following

Cytoskeleton - Microtubules, microfilaments, intermediate filaments.

Centriole

Endoplasmic reticulum, Ribosomes (Prokaryotic and Eukaryotic)Golgi complex , Lysosomes - Polymorphism - GERL concept,

Mitochondria-Endosymbiont hypothesis.

Module IV Nucleus (6 hrs)

Structure and functions of interphase nucleus, Nuclear envelope, pore complex, structure and functions of nucleolus. Chromosomes – Structure; Nucleosomes ,Heterochromatin, Euchromatin, , Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.

Module V Cell Division (3 Hrs.)

Cell cycle - G_1, S, G_2 and M phases
Mitosis and Meiosis

Module VI Cell Communication (5Hrs.)

Cell signalling ,types of signalling - Signalling molelcules (neuro- transmitters, hormones, growth factors, cytokines, vitamin A and D derivatives) Role of cyclic AMP

Aging, Apoptosis and cancer biology(Brief account only)

PART II - MOLECULAR BIOLOGY 25Hrs.

Module VII Nature of Genetic Materials (9 Hrs)

Discovery of DNA as genetic material – Griffith's transformation experiments.

Hershey Chase Experiment of Bacteriophage infection, Chemical Structure of DNA,Watson-Crick Model, Chargaff's rule ,types of DNA & RNA . DNA replication (mechanism). Modern concept of gene (Cistron, muton, recon, viral genes).

Prokaryotic genome, Eukaryotic genome, Brief account of the following-- Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons.

Module VIII Gene Expression (10 hrs)

Central Dogma of Molecular Biology, One gene-one enzyme hypothesis, One gene-one polypeptide hypothesis. Characteristics of genetic code,Transcription (Prokaryotic and eukaryotic), Reverse transcription, post transcriptional modifications, Translation, Post translational modifications.

Module IX Gene regulations (6 hrs)

Prokaryotic gene regulation (inducible, repressible systems), Operon concept -Lac operon and Tryptophan operon. Brief account of Eukaryotic gene regulation, Catabolite repression (Glucose effect).

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SEMESTER V

PROGRAMME: B.Sc. ZOOLOGY

CORE COURSE: 6 COURSE CODE: ZOO5COR06

COURSE TITLE: CELL BIOLOGY AND MOLECULAR BIOLOGY

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	2	1			1
2	6	1	1		2
3	7	2	1	1	4
4	6	1	1	1	3
5	3		1		1
6	5	1	1		2
7	9	2	2	1	5
8	10	3	1	1	5
9	6	1	1		2
Total	54	12	9	4	25

B.Sc. DEGREE (CBCS) EXAMINATION

SEMESTER V B.Sc. ZOOLOGY

ZOO5COR06 CELL BIOLOGY & MOLECULAR BIOLOGY

Time: 3hrs **Max Marks: 60**

PART – A

Answer any 10 questions. Each question carries 1 mark

1. What are viroids?
2. What is the composition of glycocalyx?
3. Define apoptosis.
4. Use of splicing of mRNA.
5. Reverse transcription?
6. How an operon works?
7. State central dogma of molecular biology.
8. What is a carcinogen?
9. The junction through which large molecules are exchanged between cells.
10. Explain Amitosis.
11. Comment on Giant chromosomes.
12. Define Genetic code. **(10x1=10marks)**

PART- B

Answer any 6 questions. Each question carries 5 marks

13. Give the structures of prokaryotic and eukaryotic ribosomes.
14. Give an account on different Models of DNA.
15. Comment on the polymorphic forms of lysosomes.
16. Explain briefly the characteristic features of cancer cells
17. Give an account tight junctions and hemidesmosomes.
18. Explain the structure of t RNA with the help of a diagram.
19. Explain the structure and functions of nuclear pore complex.
20. What is catabolite repression? Elaborate with example.
21. Explain the cell cycle.

(6 x 5 =30 marks)

PART- C

Answer any 2 questions. Each question carries 10 marks

22 Explain the structure and functions of chromosomes

23. Write a short essay on membrane transport.

24. Define operon. Describe lac operon and its control.

25.Describe the process of protein synthesis. **(2 x 10 = 20 marks)**

SEMESTER V **ZOO5P06 PRACTICAL VI**

CELL BIOLOGY AND MOLECULAR BIOLOGY

36 hrs **Credit 1**

1. Squash preparation of onion root tip for mitotic stages.Calculate mitotic index
2. Mounting of polytene chromosome (Drosophila/Chirnomous.) Demonstration only
3. Tissues (permanent slides of epithelial tissues, striated muscle, smooth muscle, cartilage, bone)
4. Identification of meiotic stages (slide/figure)
5. Cell fractionation and Identification of cell organelles. Demonstration only
6. Models (DNA, DNA replication, RNA – Different types.)
7. Preparation of temporary mount of cheek epithelium and observe Barr body
8. Extraction of DNA (demonstration only)
9. Preparation of human blood smear and identification of Leucocytes

SEMESTER V

ZOO5COR07 CORE COURSE VII

ENVIRONMENTAL BIOLOGY & HUMAN RIGHTS

Objectives

1. To impart basic knowledge on ecosystems and their functioning.
2. To study toxicants, their impacts on human health and environment and remedial measures.
3. To learn various anthropogenic pressures on ecosystems, related degradation and management measures.
4. To create awareness on disasters, prevention and mitigation measures.
5. To get an awareness on human rights.

Course Outcomes

1. Master core concepts and methods from ecological sciences and their application in environmental problem solving
2. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
3. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
5. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world and understand human rights.

54 hrs **Credits 3**

Module 1. Ecology and Ecosystems (15 hrs)

- Ecology & Environmental Science-Concept and branches.
- Concept of Biome.
- Ecosystem and its structure.
- Terrestrial ecosystem
    - Forest-Types, distribution and adaptation
    - Desert- Types , distribution and adaptation
    - Grassland – Types, distribution and adaptation
    - Tundra.
- Aquatic ecosystem
    - Fresh water ecosystem
    - Brackish water ecosystem

    - Marine ecosyste
- Coral reef and its conservation

Module 2. Environmental Issues (6 hrs)

- Causes and effects of land degradation with special reference to Kerala
- Degradation / loss of freshwater resources, wetlands / paddy fields in Kerala
- Ramsar convention and Ramsar sites in Kerala
- Impact of tourism on Environment

Module 3. Municipal Waste & Management (5 hrs)

- Types of waste
- Plastic pollution-Problems and management.
- Scope of Bioplastics.
- Medical waste: Sources, types and management strategies
- E-waste -sources, Toxic ingredients, Effects on environment and human health & Management strategies.

Module 4. Man and Environment (5 hrs)

- Natural resources- Concept and types
- Energy resources- Conventional, Non conventional
- Energy crisis and energy conservation measures
- Ecological footprint.

Module 5.Global environmental **changes** **(9 hrs)**

- Ozone depletion &Montreal Protocol
- , Green house effect & Global warming
- Climate change (Brief description only)- Definition- recent developments, Kyoto protocol, IPCC/UNFCC, Paris agreement.
- Concept of sustainable Development-UNSDGs 2030
- Carbon Footprint, Carbon credit, Carbon sequestration, carbon trading

Module 6. Disaster Management (5 hrs)

- Definition, Classification : Natural, Anthropogenic, Hybrid
- Earthquake, Landslide,Flood,Drought, Cyclone, Tsunami
- Mitigation & adaptation.

Module 7. Toxicology (4 hrs)

- Definition, History of toxicology, Classification - occurrence/ source
- Toxicants of biological origin & Non biological Origin- Afflatoxin, Botulinum toxin, Heavy metal toxicants , Food additives

Module 8. Human rights (5 hrs)

- Introduction, main concepts of human rights.
- Different types of human rights
- Role of agencies to promote human rights
- Mechanisms for checking violations of human rights
- National human rights commission
- Constitutional provisions related to human rights.

Core readings

Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission

Miller, Tyler. G. (Jr) 2005. Essentials of Ecology. Thomson Brooks/cole.

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SEMESTER V

PROGRAMME: B.Sc. ZOOLOGY

CORE COURSE: 7 COURSE CODE: ZOO5COR07

COURSE TITLE: ENVIRONMENTAL BIOLOGY & HUMAN RIGHTS

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	15	6	2	1	9
2	6	1	3	-	4
3	5	-	1	-	1
4	5	-	-	1	1
5	9	1	1	1	3
6	5	1	1	-	2
7	4	2	1	1	4
8	5	1	-	-	1
Total	54	12	9	4	25

B.Sc.DEGREE (CBCS) EXAMINATION

SEMESTER- V B.Sc. ZOOLOGY

CORE COURSE:ZOO5COR07

ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

Time: 3 Hours **Max. Marks: 60**

PART A

Answer any 10 questions. Each carries 1 mark

1. Autecology.
2. Xerocoles.
3. Continental slope.
4. Biomagnification.
5. Prairies.
6. Carbon trading.
7. Tsunami.
8. Acute toxicity
9. Benthos
10. Aflatoxin
11. National human rights commission
12. Lentic and lotic systems (**10 x 1-10 marks)**

PART B

Answer any 6 questions. Each carries 5 marks

13. Give an account of the Ramsar sites in Kerala.
14. List out the impacts of tourism on environment.
15. Classify toxicants based on their sources.
16. Explain the adaptations of desert animals.
17. Assess the major causes of land degradation in kerala
18. Give an account of plastic pollution**.**
19. Discuss the causes and mitigatory measures of drought and cyclone
20. Explain estuarine adaptations
21. Explain the concept of sustainable development (**6 x 5 = 30 marks)**

PART C

Answer any 2 questions. Each carries 10 marks

22. Give an account of energy resources.
23 Discuss the reasons and remedies for the global environmental changes.
24 Describe the toxic effects of heavy metals on organisms.
25 Explain the zonation of marine habitat with a diagram. **(10 x 2 = 20 marks)**

SEMESTER V

ZOO5P07 PRACTICAL VII

ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

36 hrs **Credit 1**

1. Estimation of dissolved oxygen
2. Estimation of dissolved carbon dioxide
3. Estimation of Soil Organic Carbon(Demonstration only)
4. Determination of pH using pH paper /digital pH meter
5. Plankton count
6. Identification of freshwater/ marine plankton
7. Extraction of soil organisms(Demonstration only)
8. Identification of minerals and rocks
9. Secchi disc, Plankton Net
10. Study of Food Chain & Food Web.
11. Compulsory Field Study report on one Terrestrial/Marine/Fresh Water/ wetland ecosystem

SEMESTER V

ZOO5COR08 CORE COURSE VIII

BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

54hrs **Credits 3**

Objectives:

1. To provide a deep knowledge in biochemistry, physiology and endocrinology.
2. To Explain the basic principles of biochemistry useful for biological studies.
3. To Explain various aspects of physiological activities of animals with special reference to humans.
4. To understand the hormonal regulation of physiological processes in invertebrates and vertebrates.
5. Will provide a basic understanding of the experimental methods and designs that can be used for further study and research.

Course outcomes

1. Provide a deep knowledge in Biochemistry, Physiology and Endocrinology.
2. Create awareness on the structure and functions of various systems in the human body, their functioning and related disorders..
3. Acquire a broad understanding on the principles of Biochemistry illustrating the different types of food, their structure, function and metabolism
4. It also throws light on the hormonal regulation of various systems of the body and the role played by various hormones in regulating the homeostasis.
5. Learn the structure and functions of bio-molecules and their role in metabolism and will contribute to the critical societal goal of a scientifically literate citizenry..

UNIT I: BIOCHEMISTRY **18 hrs**

Module 1 General Biochemistry **4 hrs**

Carbohydrates, protein and lipids: structure of basic compounds, classifications with examples and its biological importance.

Module-2 Metabolism **10hrs**

Carbohydrate metabolism- Glycolysis, glycogenolysis, gluconeogenesis, glycolysis citric acid cycle, ATP synthesis, Hexose monophosphate shunt.Lipid metabolism- Biosynthesis and oxidation of fatty acids- Beta oxidation, Physiologically important compounds synthesized from cholesterol.Protein metabolism- Deamination, transamination, transmethylation, decarboxylation, ornithine cycle. Nucleic acid metabolism- Degradation of purines and pyrimidines. Mineral metabolism- Role of Ca, Fe, Na, K and P

Module 3-Enzymes **4 hrs**

Chemical nature of enzymes, mechanism of enzyme action, factors influencing enzyme action (temperature, pH, enzyme concentration, and substrate concentration), enzyme activation, enzyme inhibition, allosteric enzyme, isoenzymes, and co-enzyme.

UNIT II: HUMANPHYSIOLOGY **25Hrs**

Module 4 - Nutrition **3 hrs**.

Food adulteration, Defects of modern food habits, Dietary fibres, Antioxidants and functions, BMI, balanced diet, Recommended Dietary Allowance, malnutrition (PEM), nutrition during pregnancy, breast feeding, anorexia, acidity and ulcers, fasting and its significance, malfunctions of gastro intestinal tract, Vitamins–source and deficiency disorders

Module 5-Respiration **5hrs**

Transport of respiratory gases, Factors affecting transport of respiratory gases through blood, respiratory pigments (haemoglobin, myoglobin), oxy-hemoglobin

curve, Bohr effect, reverse Bohr effect, Haldane effect, neural (voluntary and automatic) and chemical control (mention the role of carotid and aortic bodies) of respiration, smoking and its physiological effects, carbon monoxide poisoning, oxygen toxicity, nitrogen narcosis, dysbarism, oxygen therapy, artificial respiration, respiratory disorders hypoxia, hypocapnia, hypercapnia, asphyxia.

Module 6 Circulation **4hrs**

Cerebral circulation, blood brain barrier and cerebrospinal fluid, haemodynamic principles, formation and fate of blood cells, Haemostasis, blood clotting mechanism , intrinsic and extrinsic pathways, clotting factors, Anticoagulants, blood transfusion (safety and security problems),stroke, haemolysis, jaundice, thrombosis, ESR.

Module 7 Excretion **4 hrs**

Urine formation, Urea cycle (in detail), renal handling of individual substances eg. glucose, sodium, urea, water, factors affecting GFR, concept of plasma clearance, acid base balance and homeostasis, kidney disorders acute renal failure, chronic renal failure- glomerular nephritis, pyelonephritis, nephrotic syndrome and kidney stones.

Module 8- Muscle physiology **5 hrs**

Ultrastructure of Skeletal muscle, Electrical, chemical and morphological changes and ionic fluxes during contraction of striated muscle fibre, Cori cycle, electrophysiology of muscle, threshold and spike potentials, simple muscle twitch, whole muscle contraction- isotonic and isometric contraction, latent and refractory periods, summation, beneficial effect, superposition curve, tetanus, tonus, staircase phenomenon, fatigue, oxygen debt, rigor mortis, kymograph.

Module 9 Neurophysiology **4hrs**

Nerve impulse transmission, Regeneration of fibres and role of neurotrophins, synaptic transmission & properties of synapses, neurotransmitters, role of dopamine and serotonin. EEG, MRI, memory-short term and long term, sleep, dream. Neural disorders- dyslexia, Parkinson’s disease, epilepsy, Alzheimer’s disease, schizophrenia.

Module 10- Sports physiology **2hrs**

Muscular, Respiratory and cardiovascular changes during exercise, dope test, drug abuse. Significance of exercise in body fitness.

UNIT III : ENDOCRINOLOGY 9 hrs

Module11

Hormones as messengers, classification and types of hormones. General principles of hormone action, Concept of hormone receptors, hormonal control of homeostasis.

Secretion, Regulation, Functions and Disorders of hormones of Hypothalamus, Hypophysis, Pineal, Thyroid, Parathyroid, Thymus, Islets of Langerhans, Adrenal, Gonads, Placenta, Gastro-Intestinal endocrine glands and Tissues in Man. Endocrine Disruption-Thyroid and Sex hormones.

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SEMESTER V

PROGRAMME: B.Sc. Zoology

CORE COURSE: VIII COURSE CODE: ZOO5COR08

COURSE TITLE: BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	4	1	1	-	2
2	10	2	2	1	5
3	4	1	1	-	2
4	3	1	1	-	2
5	5	1	1	-	2
6	4	1		1	2
7	4	1	1	-	2
8	5	1		1	2
9	4	1	1	-	2
10	2	1	1	-	2
11	9	1		1	2
Total	**54**	**12**	**9**	**4**	**25**

B.Sc. DEGREE (CBCS) EXAMINATION
SEMESTER- V B.Sc. ZOOLOGY

ZOO5COR08 CORE COURSE VIII

BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

Time: 3 Hours **Maximum Marks :60**

Part A

Answer any Tenquestions.Each question carries 1 mark

1. What are essential amino acids?
2. Define gluconeogenesis.
3. Define transamination.
4. Define isoenzymes.
5. Why pregnant woman is advised a special diet?
6. Comment on GFR.
7. What is Bohr Effect?
8. What are neutrophins?
9. Why A group blood cannot be given to a B group patient?
10. Define Cori cycle.
11. What is dope test?
12. Mention hormones of placenta.

(10 x 1 = 10marks)

Part B

Answer any 6 questions; Each question carries 5 marks

13. Write the importance of Dietary fibres.

14. Comment on Carbon monoxide poisoning.

15. Explain HMP pathway.

16. Describe briefly four levels of Protein structure.

17. Briefly explain the Mechanism of enzyme action action.

18. Comment on Beta oxidation.

19. Write a detailed account on urine formation.

20. Explain the mechanism of nerve impulse transmission.

21. Describe the significance of exercise.

(6 x 5 = 30marks)

Part C

Answer any 2 questions. Each question carries 10 marks

22. Explain the mechanism of muscle contraction

23. Describe the types, functions and modes of action of major hormones.

24. Briefly explain the mechanism of blood clotting.

25. Write an essay on Glycolysis and Citric acid cycle. **(2 x 10 = 20 marks)**

SEMESTER V

ZOO5PO8 PRACTICAL VIII
BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

36hrs. **Credit 1**

PHYSIOLOGY

1. Determination of haemoglobin content of blood
2. Total RBC count using Haemocytometer
3. Differential count of WBC
4. Estimation of microhaematocrit
5. Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC (demonstration).
6. Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use) Measurement of blood pressure using a sphygmomanometer (demonstration)
7. Preparation of Haemincrystals.

ENDOCRINOLOGY

1. Cockroach: Corpora cardiac & Corpora allata (Demonstration)
2. Human hormonal disorders (Diagrams and photographs)

BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipid
2. Effect of Salivary Amylase on starch.

SEMESTER V

CHOICE BASEED CORE COURSE I

ZOO5CRE01 APPLIED ZOOLOGY PART-1

72 hours **4 credits**

Objectives

1. To learn the methods of pisciculture in fresh and brackish waters.
2. To know various techniques of culturing edible molluscs.
3. To introduce different fishing gears.
4. To understand the fish spoilage and preservation techniques to avoid it.
5. To know the steps in setting up and keeping aquariums and ornamental fish culture.

Course Outcomes

1. Get the necessary basic information about fishery and aquaculture to critically evaluate the factors which are important for a sustainable growth in the industry.
2. Learn the Impacts of aquaculture and fisheries on society, the economy, and the natural environment.
3. Learn the basic processes in fish culture, ornamental fish culture and aquariums, fish products and fish spoilage.
4. Understand, analyze and evaluate effects of the fisheries and aquaculture on the environment, to provide the preventive safety measures.
5. Develop skills in using fishing gears and aquaculture technological processes.

UNIT 1 AQUACULTURE AND FISHERY SCIENCE **46 hrs**

Module1. Aquaculture: **6 hrs**

Introduction, scope in India and Kerala, Export potential, Types of aquaculture–Freshwater, Brackish water and Mariculture. Traditional, extensive, semi -intensive and intensive culture; monoculture, polyculture, monosex culture; cage culture, pen culture; warm water and cold water aquaculture; sewage –fed fish culture, Integrated fish farming.- Rice cum fish culture

Module 2. Pisciculture and Fisheries: **31 hrs**

Construction and Management of ponds: Role of physical ,chemical and biological factors in aquaculture ,Pond preparation- Selection of site, Pond construction, Pond types, Drying, elimination of pests and predators, Liming, Manuring. **8 hrs**

Characteristics of culturable fish, fish seed collection and hatching induced breeding, stocking, feeding and harvesting, cryo preservation of fish germplasm,.

Biology and culture of Indian major carps :*Catla catla, Labeo rohita, Cirrhina mrigala*.

Biology and culture of Exotic carps:Eg: *Hypophthalmichthys molitris* – (Silver carp). **7hrs**

Inland fishes and fisheries :eg: *Channa, Clarius* – Riverine culture,estuarine culture

Plankton and Fishery production: **1 hr**

Zooplankton and Phytoplankton – Vertical migration – Plankton and Productivity.

Fish feed organisms and Artificial feed **1 hr**

Fishing Gears Cast net, Trawl net, Gill net, Purse-seines, harpoon, Chinese dip nets, echo sounders, sonar, remote sensing **3hrs** .:

Fish Spoilage and Preservation: Fish spoilage, Chilling, Drying , freezing, canning, salting, and smoking. **4 hrs**

Fish utilisation: Nutritive value, Fish by products- liver oil, body oil, fish silage,fish meal, fish flour, Isinglass, glue, skin, fin soup, lime, chitin, chitosan, beche-de-mer, Ambergris.

3 hrs

Diseases and parasites of Fish: viral, bacterial, fungal and protozoan diseases, Argulus, Anchor worm **3 hrs**

Mud banks of Kerala coast **1 hr**

Module 3. Mariculture **9 hrs**

Prawn culture: Important culture varieties, breeding and larval rearing, induced breeding- eye stalk ablation, culture methods, Harvesting.

Mussel culture: Selection of site, Seed collection, induced spawning, rearing, culture techniques, harvesting.

UNIT II ORNAMENTAL FISH CULTURE AND AQUARIUM MANAGEMENT

26Hrs

Module 4 : **10hrs**

Concept and Scope of Ornamental Fish Culture. Common fresh water ornamental fishes – indigenous and exotic species. Common marine ornamentals- fishes, crustaceans, molluscs, echinoderms etc. Sexual dimorphism in ornamental fishes. Live bearers and egg layers.

Module 5 :Breeding of ornamental fishes : 10hrs

Brood- stock management- selection of brooders, maintenance and management, general conditions for breeding-pH, temperature, sex ratio etc. Breeding of egg layers (Gold fish, Koei, Tetra, Barb, Fighter, Gourami) and live bearers (Guppy, Platy, Molly, sword fish). Induced breeding in ornamental fishes. Colour enhancement techniques in fishes

Module 6 : **Aquarium management : 6hrs**

Concept and significance, Setting up of a fresh water aquarium-Requirements and procedure. Different types of filters. Common aquarium plants. Fish feed- natural and artificial, Common diseases of aquarium fishes and their management**.**

General topics

Edible sea weeds and Sea weed culture.

Common cultivable fishes of Kerala

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SEMESTER V

PROGRAMME: B.Sc. ZOOLOGY

SEMESTER V :ELECTIVE I

ZOO5CRE01 APPLIED ZOOLOGY PART -I

Module	**HrsAlloted**	**Part A** 2 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 15 Marks 2/4	**Total questions**
1	6	2	1		3
2	31	4	4	1	9
3	9	1	2	1	4
4	10	2	1	1	4
5	10	2	1		3
6	6	1		1	2
Total	72	12	9	4	25

B.Sc. DEGREE (CBCS) EXAMINATION
SEMESTER- V, B.Sc. ZOOLOGY
CHOICE BASEED CORE COURSE I
ZOO5CRE01 APLIED ZOOLOGY PART-1

Time : 3 Hours **Maximum Marks : 80**

Part A

Answer any 10 questions.Each question carries 2 marks

1. What is purse-seine.
2. Intensive culture.
3. Fish feed.
4. Dropsy.
5. What do you mean by Monosex culture.
6. Sexual dimorphism in ornamental fishes.
7. Give the scientific names of gourami and gold fish.
8. Colour enhancement in ornamental fishes.
9. Isinglass.
10. Give the scientific names of two Indian major carps .
11. Discuss about Pokkali culture.
12. What are the general conditions of ornamental fishbreeding. **(10x2=20 marks)**

Part B

Answer any 6 questions.Each question carries 5 marks

13. Write about the role of physical and chemical factors in aquaculture.
14. Explain Fish Spoilage and Preservation
15. Write about the biology and culture of Indian major carps.
16. Write about induced breeding in fishes?
17. What do you mean by inland fisheries? List out different inland fishes.
18. Give an account on breeding of ornamental fishes?
19. Discuss about fish diseases and parasites.
20. Brief note on Mussel culture
21. Write a short note on sewage fed aquaculture **(6x5=30 marks)**

Part C
Answer any 2 questions .Each question carries 15 marks

22. Write an essay on setting up of a freshwater aquarium and its management

23. Write an essay on Pisciculture

24. Write down the procedures involved in Mariculture

25. Write an essay on Ornamental fish culture **(2x15=30 marks)**

SEMESTER VI

ZOO6COR09 CORE COURSE IX
REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

54 hrs **Credits 3**

SEMESTER VI

Objectives.

1. To provide a basic understanding of reproductive cycles.
2. To understand the development of organism from a single cell.
3. To have an understanding of birth defects and precausions to be taken to avoid them.
4. To educate students on sterility and remedies .
5. T give a better understanding of reproduction.

Course Outcomes

1. Understand the basic developmental processes that lead to the establishment of the body plan of vertebrates
2. Provide a basic understanding of the experimental methods and designs that can be used for further study and research
3. Learn the pathology related to mechanisms of development and differentiation
4. Benefit students in their further studies in the biological/physiological sciences and health-related fields
5. Contribute to the critical societal goal of a scientifically literate citizens.
6. Aquire knowledge on birth defects and causes and reduce the risk by educating society.

Module1

Introduction **12 hrs**

Scope of developmental biology, definition, sub-divisions (Descriptive, Comparative, Experimental and Chemical). Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman)

Reproductive Organs and Gametogenesis.

Human reproductive organs and gametogenesis (brief account) significance.

Egg types.

Classification of eggs, based on the amount, distribution and position of yolk. Mosaic, regulative and cleidoic eggs. Influence of yolk on development. Polarity and symmetry of egg.

Sexual cycle

Estrus cycle (non-primate) and menstrual cycle (primate cycle). Hormonal control of menstrual cycle.

Fertilization

Approach and binding of spermatozoa, activation of the egg, amphimixis.

Parthenogenesis - Classification and Significance

Module II **14 hrs**

Cleavage

Planes of cleavage. Types of cleavage: Holoblastic (equal, unequal) and Meroblastic cleavage (discoidal and superficial). Patterns of clevage (radial, spiral, bilateral). Influence of yolk on cleavage. Cell lineage (brief account)

Blastulation

Blastula formation, Types of blastula (coeloblastula, stereoblastula, Discoblastula, Blastocyst with examples).

Fate maps

Concept of fate maps, construction of fate maps. (artificial and natural). A typical vertebrate fate maps. Significance of fate map.

Gastrulation

Definition, Morphogenetic cell movements (brief account). Epiboly, Emboly (invagination, involution , delamination , convergence, divergence infiltration). Concept of germ layers (brief account) and its derivatives.

Cell differentiation and gene action

Totipotency, Pleuripotency, Unipotency of embryonic cells. Determination and differentiation in embryonic development, Gene action, control of gene expression. (Brief accounts).

Module III

Embryology of frog **22hrs**

Gamates,,fertilization, cleavage, blastulation,fatemap,gastrulation, notogenesis, neurulation,development of eye ,Metamorphosis (brief account only)

Embryology of chick

Structure of egg, fertilization, cleavage, blastulation, gastrulation. Mention brief account of 18 hour chick embryo and 24 hour chick embryo.

Human development

Blastocyst, foetal membranes and placenta. Types of placenta (brief account). Classification of placenta based on-

Nature of contact.

Mode of implantation.

Histological intimacy of foetal and maternal tissue.

Functions of placenta.

Experimental embryology

Spemann's constriction experiments, Organizer and embryonic induction. Invitro fertilization (test tube baby) Prenatal diagnostic Techniques, Embryo transfer technology, Cloning, Stem cell research.

General Topics

1. Regeneration in animals
2. Transgenic animals
3. Human intervention in reproduction- contraception & birth control, Abortion biological aspects, Ethical issues, Infertility, IVF, ICSI, GIFT, & ZIFT (Intra fallopian transfer gamete/zygote)

Module IV **6 hrs**

Teratology / Dysmorphology.

Definition, Teratogen / Teratogenic agents. Ionizing radiation, infection (herpes virus, parvo virus-B 19, rubella virus, syphilis, cytomegalovirus , toxoplasmosis).

Developmental defects

Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR)

Causes of malformation. (brief account.)

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SEMESTER VI B.Sc. ZOOLOGY

ZOO6COR09 - REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	10	6	2	1	9
2	18	3	2	1	6
3	18	1	4	1	6
4	8	2	1	1	4
Total	54	12	9	4	25

B.Sc. DEGREE (C.B.C.S.) EXAMINATION

SEMESTER VI B.Sc. ZOOLOGY

ZOO6COR09 - REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

Time: 3 Hours **Maximum Marks: 60**

PART A

Answer any 10 questions.Each question carries 1 mark

1. What is Microlecithal egg?
2. Define Amphimixis.
3. Define Spermiogenesis.
4. What is Blastocyst?
5. What are the functions of Corpus luteum?
6. Explain the term vital staining.
7. Comment on terratoma
8. Write on germplasm theory.
9. What is IUGR?
10. Comment on grey crescent.
11. Cortical reaction
12. Coeloblastula **(10 x 1 = 10 marks)**

PART B

Answer any 6 questions; Each question carries 5 marks.

13. Explain the morphogenetic movements.
14. Briefly describe test tube baby program.
15. Describe the various types of cleavage with examples.

16. Explain Spemann's constriction experiments.

17. Write on artificial insemination and its advantages.

18. Comment on estrous cycle.

19. Describe the different types of regeneration

20. Discuss the mechanisms of differential gene expression

21.Explain the causes of malformation.

(6 x 5 = 30 marks)

PART C

Answer any 2 questions . Each question carries 10 marks.

22. Explain the development of brain in frog
23. Give an account of placenta in mammals and its functions
24. Define teratology? Comment on teratogenic agents and mention the various developmental Defects.
25 Explain the menstrual cycle

(2 x 10 = 20 marks)

SEMESTER VI
ZOO6P09 PRACTICAL IX
REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

36 hrs **Credit 1**

Practical

Model/Chart/ Slide may be used

1. Comparative study of eggs.
2. Embryological studies- Blastula, gastrula (frog, chick)
3. Amniocentesis., Embryo Transfer
4. Study of placenta- pig and man
5. 18 hour, 24 hour, 33 hour and 48 hour chick embryo (18-48 hrs, any four slides).
6. Candling method.
7. Vital staining.
8. Regeneration studies.
9. Reproductive system of Cockroach/fish
10. Calculation of gonadosomatic index Cockroach/fish

SEMESTER VI

ZOO6COR10 CORE COURSE X

GENETICS AND BIOTECHNOLOGY

54 hrs **Credits 3**

Objectives of the Course

1. To make students understand and appreciate the mode of inheritance.
2. To introduce the development and applications of biotechnology
3. To critically evaluate the application of the principles of Genetics And Biotechnology
4. To inculcate curiosity on the occurrence of sex linked diseases.

Course Outcomes

1.Learn the pattern of inheritance of characters.

2.Understand the central role that genetics and biotechnology plays in the life of all organisms.

3.Aquire the knowledge on sex determination, linkage groups and linkage map, crossing over and non- disjunction of genes in animals.

4.Learn the extra nuclear inheritance, bacterial and human genetics

5. Aquire the development and applications of biotechnology & gene cloning.

UNIT I GENETICS **36hrs**

Module I Mendel's Experiments, Monohybrid cross, dihybrid cross, test cross, back cross, reciprocal cross. Principles of inheritance. Chromosome theory of heredity. **3 hrs**

Module II Interaction of genes: (Brief account with one example each)

Allelic interactions - incomplete dominance, Co-dominance

Non allelic interactions - complementary, supplementary, dominant epistasis (feather colour in fowl), recessive epistasis (coat colour in mice), Polygenes (Skin colour inheritance in man), pleiotropism, modifying genes, lethal genes with example.

Multiple allelism (eg) Coat Colour in rabbits. ABO Blood group system, Rh group and its inheritance in man. Erythroblastosis foetalis.

6hrs

Module-III Linkage and recombination, Linkage and recombination of genes based on Morgan's work in Drosophila (Complete and incomplete linkage). Linkage map, Chromosome mapping - two point and three point test cross. Elementary knowledge of mapping principles.

3hrs

Module IV Sex determination: Chromosome theory of sex determination (sex chromosomes and autosomes) chromosomal mechanism (XX-XO, XX-XY, ZW-ZZ) Barr bodies, Dosage compensation & Lyon hypothesis : Sex determination in man- role of Y chromosome , Genes involved in sex determination. Sex determination in honey bees. Genic balance theory. Drosophila- intersex, gynandromorphs, sexmosaics, Hermaphroditism Freemartin. Hormonal Influence on sex determination. Environmental influence on sex determination.

4hr

Module V Mutations: Types of Mutations. Somatic, Germinal, Sex linked. Chromosomal mutations - structural and numerical changes. Gene mutation- types. Molecular basis of gene mutations tautomerism- Induced mutations - Physical and chemical mutagens .Factors affecting mutation **4hrs**

Module VI Extra nuclear inheritance (Cytoplasmic inheritance Characteristics: Organellar DNA Mitochondrial and plastid DNA) Kappa particles in *Paramecium*, Epigenetics –brief accounts. **2hrs**

Module VII Bacterial genetics; Bacterial genome Recombination in Bacteria. Bacterial transformation. Transduction, conjugation F mediated sexduction. Resistance transfer factor (RTF). Mechanism of drug resistance in bacteria Transposable genetic elements in bacteria-basic components and mechanisms of transposition in bacteria.

5hrs

Module VIII Human Genetics: Karyotyping- Normal human chromosome complement. Pedigree Analysis. Aneuploidy and Non disjunction. Genetic disorders in Man - Chromosomal anomalies, Autosomal (eg. Down syndrome, Edward's syndrome and Cridu chat syndrome), Sex chromosomal anomalies (Kline felters syndrome, and Turners syndrome). Single gene disorders – Autosomal, single gene disorders (Sickle cell anaemia, brachydactyly; inborn errors of metabolism such as phenyl ketonuria, alkaptonuria,Albinism). Sex linked inheritance - Haemophilia and colour blindness. Pseudoautosomal genes (incompletely sex-linked genes and holandric genes). Multifactorial disorders - Polygenic traits - Cleft lip and cleft palate. Sex limited and sex influenced traits in man with examples. Genetic counselling, Eugenics and Euthenics. **9hrs**

UNIT II BIOTECHNOLOGY 18hrs

Module IX Basics of Biotechnology: Introduction, Definition, Brief history and scope of biotechnology **1hr**

Module X Techniques in gene cloning: Fundamental aspects of genetic engineering and recombinant DNA technology. Major steps - Cutting and joining of DNA. Role of Restriction endonucleases, Ligases and cloning vectors (Plasmid or phage vectors -characteristics and types). Blotting techniques- Southern, Northern and Western. DNA amplification by PCR technique. DNA hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. DNA finger printing and its applications. RFLP- Applications: Gene libraries. Virus mediated gene transfer, DNA mediated gene transfer, gene therapy. Stem cells cultures- Types. Human ES cell cultures, Human EG cell cultures and Human EC cell cultures, Potential uses of stem cells **10hrs**.

Module XI Practical Applications of Biotechnology

Tissue culture- Principle and uses Technology of mammalian and plant cell culture. Single cell protein (SCP) , economic implications of SCP.

Biotechnology and Medicine: Pharmaceuticals and Biopharmaceuticals (insulin, somatostatin, interferon, Lymphokines) Antibiotics, Vaccines and monoclonal antibodies Biotechnology in agriculture and forestry Microbial insecticides, improved resistance to insect pest and microbial diseases. Production of transgenic plants; Animal biotechnology, Genetic Engineering for transgenic animals. Genetically engineered hormones and vaccines. Fermentation technology, food and beverage fermentations. CRISPR technology and its implications.

4hrs

Module XII Potential Hazards of Biotechnology

Advantages and hazards of genetic engineering, Problems of biologically active biotechnology products. Problems of biotechnological inventions: Patent protection , Trade secrets, Plant breeders rights. Biowar and biopiracy.

3 hrs

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SEMESTER VI

PROGRAMME: B.Sc. ZOOLOGY

CORE COURSE: 10 : ZOO6COR10

COURSE TITLE: GENETICS AND BIOTECHNOLOGY

	HrsAlloted	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	3	1	1	-	2
2	6	2	1	-	3
3	3	1	-	-	1
4	4	2	1	-	3
5	4	1	1	1	3
6	2	1	-	-	1
7	5	1	1	-	2
8	9	1	2	1	4
9	1	-	-	-	-
10	10	2	1	1	4
11	4	-	-	1	1
12	3	-	1	-	1
Total	54	12	9	4	25

B.Sc. DEGREE (C.B.C.S.) EXAMINATION
SEMESTER VI B.Sc. ZOOLOGY
ZOO6COR10 GENETICS AND BIOTECHNOLOGY

Time:3 Hours **Maximum Marks:60**

Part A

Answer any 10 questions.Each question carries 1 mark

1. Define co dominance
2. What is linkage?
3. What is Barr body?
4. What is point mutation?
5. Define epigenetics
6. Write the genotypic variation of Turners and Klinfilters syndrome
7. What is gynandromorphy
8. Write any two examples of multiple allelism
9. Define conjugation
10. Give the significances of ligases
11. What is RFLP?
12. Mention chromosome theory of heredity **(10x1=10 Marks)**

Part B

Answer any 6 questions. Each question carries 5 marks.

13. Explain sex linked inheritance with examples.
14. Give biological significance of Gene therapy
15. Briefly explain environmental influence of sex determination
16. Give a short note on various mutagens
17. Write a note on dominant and recessive epistasis
18. What are transposable elements?
19. Differentiate between cleft lip and cleft palate
20. Explain bio war and bio piracy
21. Explain Mendel's principles of inheritance.

(6 x 5 = 30 marks)

Part C

Answer any 2 questions . Each question carries 10 marks.

29. Describe the principle and procedure of PCR.
30. Define mutation .Give a detailed account on the molecular mechanism of mutation
31. Write an essay on applications of biotechnology in medicine
32. Write an essay on genetic disorders in man. **(2 x 10 = 20 marks)**

SEMESTER VI

ZOO6P10 PRACTICAL X

GENETICS AND BIOTECHNOLOGY

36 hrs **Credit 1**

1. Genetic problems – (Problems from each type)

   Steps in solving genetic problems

   1. Mono and Dihybrid ratio (b) Back cross (c) Multiple alleles.
2. Study using photographs of the Karyotype- Turner's Syndrome , Klinefelter's and Down's Syndrome (Any human genetic disorders)
4. Study of the karyotype and idiogram from the given photograph of somatic metaphase chromosome-(Human)
5. Pedigree chart construction.
6. Sexing of *Drosophila melanogaster.*
7. Study of Polymerase Chain Reaction & Agarose Gel Electrophoresis (Demonstration)
8. Western blotting of proteins from SDS-Polyacrylamide gel (Demonstration)
9. Southern blotting of DNA fragments from agarose gel (Demonstration)
10. Northern Blotting of RNA molecules (Demonstration)

(Students are expected to visit the near by research institution / Biotechnology departments/ research centre, and see the demonstration of practicals 7, 8,9 and 10 or using virtual lab, if they do not have such facility in their institution

SEMESTER VI

ZOO6COR11 CORE COURSE XI
MICROBIOLOGY AND IMMUNOLOGY

54 hrs **Credits 3**

Objectives

1. To make them aware of the pathogens, health related problems, their origin and treatment.
2. To know various Culture media and their applications.
3. To get equipped with various methods of bacterial growth measurement.
4. To learn the organization of the immune system, the salient features of antigens & antibodies and their reactions.
5. To make them aware of immune disorders and remedies.

Course outcomes

1. Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes
2. Learn various physical and chemical means of sterilization, Physical and Chemical growth requirements of bacteria.
3. Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae and master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.
4. Understand the key concepts in immunology, its uses in diagnostics and various other studies
5. Learn about immunization, their preparation and its importance

UNIT I MICROBIOLOGY **28 hrs**

ModuleI Introduction and Scope of Microbiology **1 hr**

Outline classification of bacteria, fungi, viruses, actinomycetes and mycoplasma

Module II Methods in Microbiology **6 hrs**

Sterilization and disinfection. Different methods, physical and chemical. Sterilization by moist and dry heat, by filtration, by irradiation, preparation of culture media (aerobic and anaerobic cultivation) Selective media, enrichment media and differential media, Plating techniques and isolation of pure colonies, culture preservation techniques: refrigeration, deep freezing, freezing under liquid nitrogen and lyophilization. Staining-

	Gram's staining and Acid fast staining.	
Module III	Morphology and fine structure of bacteria, size, shape and arrangements. Flagella, Pili, Capsule, cell wall and its composition, Cytoplasmic membrane, protoplast, spheroplast, nuclear material, cell inclusions, Bacterial spores Bacterial Growth, Effect of various factors on bacterial growth. Eg (*E. coli)* Modes of cell division. Nutritional requirements. Bacterial growth curve, Enumeration of bacteria	**5 hrs**
Module IV	Antimicrobial Drugs Mode of action of antimicrobial drugs Inhibition of cell wall synthesis, inhibition of protein synthesis, injury to the plasma membrane, inhibition of nucleic acid synthesis and inhibition of synthesis of essential metabolites. Multiple drug resistance	**3hrs**
Module V	Viruses - Structure of Viruses - Human, Animal, Plant and Bacterial Viruses. Replication of viruses, cultivation of animal and plant viruses. Viral assay.	**3 hrs**
Module VI	**Infections** Types-Primary, secondary infections. Cross infection, nosocomial infection. Endogenous and Exogenous infections, different sources of infections. Contagious diseases (Epidemic, endemic and pandemic) modes of transmission of diseases (by food, water, air, vectors, and carriers. Mention different types of carriers, healthy carriers, convalescent carriers, temporary and chronic carriers, contact carriers, paradoxical carriers , bacteraemia, Septicemia.	**4 hrs**
Module VII	Diseases caused by different pathogens, epidemiology, symptomology, diagnosis and treatment Bacterial: Mycobacterium (*M. tuberculosis, M leprae*) (TB and leprosy) *Salmonella* (Typhoid) *Clostridium* (Tetanus and Botulism Spirochete disease (Leptospirosis, Syphilis) Fungal: *Tinea* or ring worm (Dermatophytoses,) *Candida albicans* (Candidiasis) Viral : Herpes virus (Chicken pox) Influenza, Chickunguniya Dengue and Zika virus. Applied Microbiology- Microbial food spoilage. Metagenomics and bioprospecting. Waste water treatment. Biodegradation and Bioremediation.	**6 hrs**
UNIT 11 IMMUNOLOGY		**26 hrs**
Module VIII	Introduction to immunology Types of immunity, innate immunity, acquired, passive, active. Mechanism of innate immunity (eg. Barriers, Phagocytosis, inflammation. Complement system, biological effects of complements	**3 hrs**

Module IX Antigens and Antibodies **10hrs**

Types of Antigens, haptens, antigenic determinants. Basic structure of immunoglobulins. Different classes of immunoglobulins and functions.

Antigen-antibody reactions- Precipitation test, Agglutination Test. Clinical applications of antigen antibody reaction : Eg: Widal, VDRL, ELISA test Complement fixation test, Coombs test.

Module X Immune Response system **8 hrs**

Primary and secondary lymphoid organs. Cells of the immune system Leucocytes, Lymphocytes T & B cells, Macrophages, Plasma cells, Memory cells, MHC Antibody synthesis, primary and secondary responses, Monoclonal antibodies Hybridoma technology, uses, Polyclonal antibodies.

Vaccines: Brief history of vaccination, principles of vaccines, major types of vaccines (BCG, DPT, Polio vaccine and TAB vaccines) DNA vaccines, toxoides, adjuvants. Recent trends in vaccine preparation

Module XI Immunopathology- immune disorders **5hrs**

(Hypersensitivity, autoimmunity and immunodeficiency)
Different types of hypersensitivity reactions - Type I, Type II, Type III)
Autoimmunity, Autoimmune diseases (Rheumatoid arthritis, Addison's disease and SLE -brief account)
Transplantation Immunity- Graft rejection, major histocompatibility, Human leukocyte antigen system - (HLA) immuno -suppression.
Tumour immunity-Immune responses in malignancy, Immunotherapy
Immunodeficiency- AIDS

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Tortora (p584-586) Gerard J. Tortora , Berdell R. Funke Christine L. Microbiology :An introduction

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SEMESTER VI

ZOO6COR11 CORE COURSE XI
MICROBIOLOGY AND IMMUNOLOGY

Module	**HrsAlloted**	**Part A** 1Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	1	1			1
2	6	1	2	1	3
3	5	1	1		2
4	3	1	1		2
5	3	1	1		2
6	4	1	-		1
7	6	1	1	1	1
8	3	1	1		3
9	10	2	1	1	1
10	8	1		1	2
11	5	1	1		2
Total	54	12	9	4	25

B.Sc. DEGREE (CBCS) EXAMINATION
SEMESTER- VI, B.Sc. ZOOLOGY
ZOO6COR11, MICROBIOLOGY AND IMMUNOLOGY

Time: 3 Hours **Max. Marks: 60**

Part A

Answer any 10 questions. Each carries 1 mark

1. What are Actinomycetes?
2. Define Pili.
3. Define Septicaemia.
4. Write short notes on Prions.
5. Define Enrichment media.
6. Define Haptens.
7. Write short notes on HLA.
8. What is Widal test?
9. Write short notes on SLE.
10. Write notes on Zika virus.
11. Write notes on DNA vaccines.
12. What is MPN? (**10x1 = 10 marks)**

Part B

Answer any 6 questions. Each carries 5 marks

13. Write notes on bacterial growth curve.
14. Describe Gram staining technique.
15. Write notes on morphology and fine structure of bacteria
16. Discuss briefly modes of action of antimicrobial drugs.
17. Write notes on clinical applications of antigen antibody reaction
18. Explain the different mechanism of innate imunity
19. Write notes on Hybridoma technology.
20. Comment on AIDS
21. Give an account of viral diseases (**6 x 5 = 30 marks)**

Part C

Answer any 2 questions . Each carries 10marks

22. Describe the epidemiology, symptoms and treatment of bacterial diseases.
23. Write an essay on different sterilization and disinfection methods used in microbiology.
24. Describe the basic structure of Immunoglobulin. Add notes on types of Immunoglobulin.
25. Write an essay on lymphoid organs.

(2x10 = 20 marks)

SEMESTER VI

ZOO6P11 PRACTICAL XI
MICROBIOLOGY AND IMMUNOLOGY

36 hrs **Credit 1**

1. Instruments -Autoclave, Hot air oven, Bacteriological incubator, Working and use in Microbiology lab.
2. Cleaning and sterilization of glasswares
3. Preparation of solid and liquid media for microbial cultures (Ingredients, pH and method of preparation)
   (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar
   (b) Liquid Media (1) Nutrient broth (2) Peptone water.
   (c) Semi solid agar
   (d) Firm agar
4. Culture methods
   (a) Streak plate technique and isolation of pure colonies.
   (b) Lawn culture (c) Stab culture
   (d) Pour plate culture
   (e) Liquid culture
5. Serial dilution and Standard Plate Count (SPC) calculation of Cfu /ml in well water sample (demonstration).
6. Examination of microbes in living condition
   (a) Wet mount
   (b) Hanging drop method for demonstrating motility of bacteria.
7. Gram staining: preparation, procedure, identification of Gram + ve and Gram¯ve bacteria.
8. Antibiotic sensitivity test (demonstration).
9. Preparation of a fungal smear: Lactophenol cotton blue staining and mounting
10. Determination of ABO blood groups and Rh factor (Antigen -antibody Reaction)
11. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man.

SEMESTER VI

ZOO6COR12 COURSE XII

EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY

54 hrs **Credits 3**

Objectives:

1. To acquire knowledge about the evolutionary history of earth (living and non living)
2. To learn various tools and techniques for evolutionary studies
3. To study the distribution of animals on earth, its pattern, evolution and causative factors.
4. To impart basic knowledge on animal behavioural patterns and their role.
5. To understand the causes and consequences of mass extinctions & geological periods in which they occurred.

Course Outcomes

1. Understand evolutionary history of earth (living and non living).
2. Learn various theories of evolution of life
3. Understand the relationship between evolution and population genetics
4. Learn various tools and techniques for evolutionary studies.
5. Gain knowledge on zoogeographical division and distribution of animals on earth, its pattern, evolution and causative factors
6. Aquire basic knowledge on animal behavioural patterns and their role in the formation of social groups.

Module I Origin of life **(5 hrs)**

Introduction

Concepts of origin of life – Panspermia, Special creation, Spontaneous generation

Abiogenesis & Biogenesis, Intelligent Design. (Brief account only)

Chemical evolution- Haldane and Oparin theory, Miller-Urey experiment.

Evidences of evolution

Homologous organs, analogous organs, Fossils- Kinds of Fossils & Fossilization.

Dating of Fossils-Relative & absolute dating, Stratigraphy, Biostratigraphy.

Radiometry- Carbon dating. Significance of fossils

Module II Theories of organic evolution 6 hrs

Lamarckism.

Critical analysis of Lamarcks propositions.

Germplasm theory.

Darwinism and Critical analysis of Darwinism.

Mutation theory.

Modern Synthetic theory.

Neutral theory of molecular evolution.

Module III Population genetics and evolution 6 hrs

Gene pool, Gene frequency, Hardy Weinberg equilibrium.

Factors affecting genetic Equilibrium- Population size, Non Random mating, Gene flow,

Genetic drift -Bottle neck & Founder principle, mutation and Natural selection.

Module IV Evolution above species level 9 hrs

Adaptive radiation, Microevolution, Macroevolution, Mega evolution.

Gradualism vs Punctuated equilibrium.

Evolution of horse & man.

Isolation and Isolating Mechanism- Geographical and Reproductive isolation.

Natural selection types and examples.

Speciation –Types (Phyletic, True- Sympatric, Parapatric, Peripatric, Allopatric)

Module V Geological time scale 4 hrs

Geological Time scale – Anthropocene.

Mass extinctions.

PART II ZOOGEOGRAPHY AND ETHOLOGY 24 hrs

Module VI Zoogeography: Introduction 5 hrs

Origin of oceans and continents. Plate tectonics. continental drift.

Zoogeographical realms - Wallace's line, Weber's line.

Insular fauna (Fauna of Oceanic & continental islands.

Biogeography of India with special reference to the Western Ghats.

Module VII Animal distribution 5 hrs

Types and means of animal distribution -cosmopolitan distribution, discontinuous distribution, bipolar distribution and isolated distribution.

Factors affecting animal distribution- barriers to animal distribution- physical, Climatic and biological barriers.

Module VIII Ethology 9 hrs

Definition.

History and scope of ethology.

Patterns of Behaviour

Motivation- models of motivation (Lorenz's psychohydraulic modeland Deutsch's model).

Learning- types of learning (trial and error learning, imprinting, habituation, Conditioned reflex, unconditioned reflex, latent learning & insight learning)

Innate behaviour : Reflex , instinct, Taxes & Kinesis.

Biorhythms: Photoperiodism, Circadian & Seasonal rythms (diapause, hibernation and aestivation)

Migration, Navigation & Homing instinct.

Module IX Socioethology **5 hrs**

Social groups- Main attributes – Co-operation, Territoriality, Dominance Hierarchies, Leadership and Parental care & mutual stimulation. Merits & Demerits.

Social organization in insects (Ants, Termites, Wasps and Honey bees) and primates (Monkeys, Gorilla & Chimpanzee).

Pheromones and chemical communications - human pheromones.

REFERENCES **:**

Barnes, C.W. 1988. *Earth, Time and Life*. John Wiley &Sons, NewYork (Module 2 & 3)

Bendall , D. S. (ed.)1983.*Evolution from Molecules to Man*. Cambridge University Press,U.K.(

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Strickberger, M.W.2000. *Evolution*. Jones and Bartlett, Boston. (Module 1-5)

Verma P.S. and Agarwal V.K 2007 *Cell biology, Genetics, Molecular Biology, Evalution and Ecology,* S. Chand & Company New Delhi (Moldule 1-5)

Andrews. M.I and Joy, K.P. 2003. *Environmental biology, evolution, ethology and Zoogegraphy.* St.Marys press and book dept. (Module Vi, VII, VIII and IX)

Briggs, J.C. 1996. *Global Biogeography.* Elsevier Publishers. (Module VI and VII).

Chundamannil , Mammen.1993. *History of Forest management in Kerala*. Report number 89. Kerala Forest Research Institute, Peechi, India.

Daniels, R.J.R and J.Vencatesan .2008. *Western Ghats Biodiversity.People.Conservation*. Rupa &Co.New Delhi.India.

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Nair, C.S.1991. *The Southern Western Ghats : A Biodiversity Conservation Plan*. INTACH, New Delhi.

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David McFarland. 1999. *Animal Behaviour*. Pearson Education Ltd . Essex, England. (Module 8 and 9)

Dawkins, M.S. 1995.*Unravelling Animal Behaviour*. Harlow:Longman. (Module 8, 9 and 10)

Manning Aubrey and Marian Stamp Dawkins 1998. *An Introduction to Animal Behaviour*.Cambridge University Press,UK. (Module 8, 9 & 10)

Paul W. Sherman and John Alcock.,2001 Exploring Animal Behaviour- Readings from American Scientist 3rd Edn. Sinauer Associates Inc. MA,USA. (Module 10 & 11)

Wilson, E.O. 1975. Sociobiology. Harvard University Press, Cambridge, Mass. USA. (Module 9)

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SEMESTER VI

PROGRAMME: B.Sc. Zoology

CORE COURSE: COURSE CODE: ZOO6COR12

COURSE TITLE: EVOLUTION ZOOGEOGRAPHY AND ETHOLOGY

Module	**Hrs Alloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	5	1	1	-	2
2	6	1	1	1	3
3	6	2	1	-	3
4	9	2	2	1	5
5	4	1	-	1	2
6	5	1	1	-	2
7	5	1	1	-	2
8	9	2	1	-	3
9	5	1	1	1	3
Total	**54**	**12**	**9**	**4**	**25**

B.SC DEGREE (C.B.C.S.)EXAMINATION

SEMESTER VI. B.Sc. ZOOLOGY

ZOO6COR12 EVOLUTION ZOOGEOGRAPHY AND ETHOLOGY

Time:3 Hours **Maximum Marks:60**

Part A .

Answer any 10 questions. Each question carries 1 mark

1. What is a homologous organ?
2. State germplasm theory
3. Explain genetic drift
4. Gene pool.
5. What is microevolution?
6. Geographical isolation
7. What is geological time scale?
8. What is insular fauna?
9. Discontinuous distribution.
10. What is reflex?
11. Homing instinct
12. Define dominance

(10x1= 10 Marks)

Part B

Answer any 6 questions. Each question carries 5 marks.

13. Explain Oparin and Haldane theory of origin of life

14. What is mutation . Explain its significance in evolution

15. Hardy Weinberg equilibrium & factors affecting it.

16. Explain isolation and isolating mechanism

17. Types of natural selection.

18 .Comment on the significances of north eastern zone

19. Write a note on factors affecting animal distribution.

20. Discuss the types of learning .

21. Pheromones. **(6 x 5 = 30 marks)**

Part C

Answer any 2 questions. Each question carries 10 marks.

22. Darwinism and its Critical evaluation.

23. Write an essay on speciation.

24. Write an essay on Geological time scale.

25. What is socio biology? Discuss the primate social group .

(2x 10 = 20 marks)

SEMESTER VI

ZOO6P12 PRACTICAL XII

EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

Credit 1 **36 Hrs**

1. Identification of Zoogeographical realms using map
2. Study on endemic species of each realm
4. Providing a map mark any two continental/oceanic islands.: Greenland, Madagascar, New Zealand, New Guinea, Maldives, Iceland, Hawaii – any two
5. Identification of different stages of horse evolution
6. Study on Homology and Analogy
7. Study on connecting links (*Peripatus*, Archaeopteryx, *Protopterus*)
8. Pheromone traps
9. Skinner box & T Maze
10. Experiment to demonstrate Phototaxis and Chemotaxis using Drosophila/House fly
11. Identification of behaviour (Grooming/courtship dance of flamingos/stickle back fish/ Tail wagging dance/ Aggressive behaviour/ Auto/Allo grooming, Flehmen response) showing pictures (Any five).
12. Response of animals to chemicals/stress.

SEMESTER VI

CHOICE BASED CORECOURSE-II

ELECTIVE II

ZOO6CRE02 APPLIED ZOOLOGY PART -II

72 hrs **Credits 3**

Objectives of the Course

1. To aquaint the students with the common agricultural pests and their control measures.
2. To study the scientific methods of bee keeping and silkworm rearing.
3. To familiarize with the various economically important breeds of poultry and cattle.
4. To have an idea on the common diseases to which the live stock is vulnerable.
5. To gain practical knowledge through the nearby dairy & poultry farms.

Course Outcomes

1. Understand the various factors and acquire scientific knowledge regarding the culturing of various organisms for economic growth
2. Design one's own small scale industry in any one of the studied types with effectiveness as means of self employment.
3. Start ecofriendly agricultural practices using the knowledge gained during the course
4. Develop the skill in culturing of various animals in aquaculture, poultry etc.
5. Design corrective measures for the control of agricultural pests.

UNIT I. APPLIED ENTOMOLOGY **18hrs**

Module I Pests of common crops of Kerala **10 hrs**

Morphology, damages caused and control measures.

Pest of paddy –*Spodoptera mauritia* (Rice swarming caterpillar), *Scirpophaga incertulas*

(Rice stem borer), *Leptocorisa acuta* (Paddy stink bug), *Nilaparvata lugen* (Brown plant hopper).

Pests of coconut – *Oryctes rhinoceros* (Rhinoceros beetle), *Rhyncophorus ferrugineus* (Red palm weevil*), Opisina arenosella (* Black headed coconut caterpillar), *Aceria guerreronis* (Eriophid mite).

Pest of stored food products – *Trogoderma granarium*(Khapra beetle), *Tribolium castaneum* (Red flour beetle), *Sitophilus oryzae* (Rice weevil), *Callasobruchus chinensis* (Pulse beetle).

Insect pest management **8 hrs**

Chemical control- Classification and chemical composition of pesticides Insecticides and their mode of action, trade names, Biological control methods – give examples, insects used in biological control programme Microbial insecticides, Autocidal control (sterile male technique) IPM – Integrated Pest Management.

Module II – APICULTURE **18 hrs**

Bee Keeping -Definition, Different species of honey bees,Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees, Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, Honey flow period and Dearth period, Division of the colony, Uniting two colonies, replacing old queen with new queen, Swarming management, Monsoon Management. Enemies of bees. Bee diseases. Uses of honeybees, By-products of honey bees. Honey and wax composition Bee pasturage. Testing the quality of honey. Extraction of wax, Royal Jelly,Propolis, Apitherapy Uses of honey and wax. Apitherapy.Agencies supporting apiculture. Melipony Culture.

Module III Sericulture **6hrs**

History and Scope of sericulture, Types of Silk, Life Cycle,-stages, Silk gland, Composition of Silk, Uses of Silk, Mulberry Silk Culture-Mulberry plant rearing and Silkworm rearing, Management of Mounting and Cocoon Harvesting.

Extraction of silk -Reeling, Stifling, Deflossing, Types of Silks, Diseases (Protozoan, Bacteria, Fungal and Viraldiseases (one disease for each) and Pest of Silkworm

UNIT 2 Poultry Science **12 hrs**

Module IVIntroduction and Scopeof Poultry production

Breeds of Poutry – Exotic American Class, English Class, Asiatic Class (one example from each)Indigenous- Aseel, Bursa and Chittagong

Methods of Breeding-, Selection of breeders, Selection for egg and broiler production,Systems of breeding and mating,Artificial Insemination**Hatchery Management**: Incubation of eggs, Sexing**.Poultry Houseand Management and Equipment**: Free range system, Semi-intensive system and Intensive system .**Nutrion of Poultry Birds** Nutrient requirement according to age,

feed formulation, Feed Stuffs, Cannibalism and Debeaking, Culling Common diseases of Poultry (Ranikket, Fowl pox –Virus Pullorum- Bacteria).

UNIT 3 Animal husbandry

7 hrs

Module V- Brief introduction-Advantages and limitations of Dairy farming.

Breeds of Diary Cattle:Indian breeds- Milch breeds(Gir and Sindhi)Draught breed: Nagori &n Kangayam, Dual purpose: Ongole, Hariana Exotic breed : Jersey, Holstein – Friesian Native breeds- Vechur Cow

Feeding, Common diseases: Anthrax, Foot & Mouth disease. Parasites.

Meat hygiene: Slaughter and clean meat production – Zoonotic diseases.

Module VI Dairy Science **4 hrs**

Role of dairy development in rural economy employment opportunities, white revolution.

Composition of Milk, Adulteration of Milk.

Dairy processes: Pasteurisation- Types of Pasteurisation, Sterilization, Skimmed and tonned milk.Artificial milk

Field visit and report writing **7 hrs**

Field visit and report writing on any two items are taken for internal evaluation, instead of assignment and seminar

Core readings:

Nair M R G K- Insect pests of Crops of India

Vijayakumaran Nair – Protista & Animal Diversity. Academica Press. 2009

Nair K K. Ananthakrishnan, T N David, B V. 1976 – General & Applied Entomology

M S Mony – Applied Entomology

Larry P. Pedigo, Entomology and Pest management, prentice hall of India Delhi.

NPCS Board, The complete book on Bee keeping and honey processing, NIIR Project consultancy services, 106- E kamala nagar Delhi – 110007.

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SEMESTER V

PROGRAMME: B.Sc. ZOOLOGY

SEMESTER VI :ELECTIVE II

ZOO6CRE02 APPLIED ZOOLOGY PART -II

Module	**HrsAlloted**	**Part A** 2 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 15 Marks 2/4	**Total questions**
1	18	3	2	1	6
2	16	3	2	1	6
3	6	2	1	-	3
4	14	2	1	1	4
5	7	1	2	1	4
6	11	1	1	-	2
Total	72	12	9	4	25

MODEL QUESTION PAPER

SEMESTER VI : ELECTIVE II

ZOO6CRE02 APPLIED ZOOLOGY PART -II

Time : 3 Hours **Max.marks:80**

I. Answer any 10 of the following. Each question carries 2 marks.

1.Paris Green.

2.Scientific name of two stored grain pest.

3. Royal Jelly.

4. Scientific name and host plant of Mulberry Silk worm.

5. IGR's.

6. Propolis.

7. Cannibalism.

8. Composition of Silk.

9. Pullorum Disease.

10. Skimmed and Toned Milk.

11.Dearth period.

12. Anthrax. **(10x2=20marks)**

II. Answer *any six* of the following. Each question carries 5 marks.

13. Bee pasturage.

14. Explain the different methods of Extraction of Silk.

15. Give an account on the Advantages and limitations of Diary farming.

16. Explain Pasteurisation of Milk.

17. Communication among Honey Bees.

18. Describe the morphology, damage caused and control measures of two pest of Paddy.

19. Explain IPM.

20. Describe different types of Poultry housing.

21. Give a short account on Meat Hygiene. **(6x5=30 marks)**

III. Answer *any two* of the following .Each question carries 15marks

22.Write an essay on different breeds of dairy cattle

23. Explain the different methods of breeding and hatchery management in Poultry farming

24. Describe the Organization of honey bee colony, Social life and adaptation.

25. Give an account on the non-chemical control measures used against Insect Pest

(2x15=30 marks)

Semester I

COMPLEMENTARY COURSE BOTANY-I

ZOOICMP01 ANIMAL DIVERSITY – NON CHORDATA

36 hrs **Credit 2**

Objectives

1. To acquire knowledge on the taxonomic status of the various nonchordate animals.
2. To familiarise the students with the diverse groups of organisms around them.
3. To develop an aptitude for understanding nature and its rich biodiversity.
4. To study the evolutionary advancement in each invertebrate group.
5. To learn the body organization in each phylum.

Course outcomes

1. **A**cquire the skill for the arrangement of the various nonchordate animals taxonomically.
2. Aquaint with the diverse groups of organisms around them.
3. Understand nature and its rich biodiversity.
4. Apply the knowledge to identify the animals coming across .
5. Inculcate curiosity to know the animal world along with plants.

Module I : General Introduction to Non Chordata **7hrs**

Five Kingdom classifications

Kingdom Protista

Salient features and classification up to phyla

1. Phylum Rhizopoda : Amoeba
2. Phylum Actinopoda : Actinophrys
3. Phylum Dinoflagellata : Noctiluca
4. Phylum Parabasalia : Trychonympha
5. Phylum Metamonada : Giardia
6. Phylum Kinetoplasta : Trypanosoma
7. Phylum Euglenophyta : Euglena
8. Phylum Cryptophyta : Cryptomonas

9. Phylum Opalinata : Opalina
10. Phylum Choanoflagellata : Proterospongia
11. Phylum Ciliophora : Paramecium
12. Phylum Sporozoa : Plasmodium

13. Phylum Microsporidia : Nosema

Module II **7 hrs**

Kingdom: Animalia (Salient features, Classification up to classes) **1 hr**

Sub Kingdom: Mesozoa – eg: Rhopalura (mention 5 salient features

Sub Kingdom : Parazoa

Phylum : Porifera . **2 hrs**

Class: Calcarea. E:.Sycon; Class:Hexactinella. Eg : Euplectella; Class: Desmospongia. Eg: Cliona.

Sub Kingdom : Eumetazoa

Phylum : Coelenterata **3hrs**

Class 1. Hydrozoa – Physalia

Class 2. Scyphozoa – Rhizostoma

Class 3. Anthozoa – Adamsia

General topic: Corals and Coral Reefs

Phylum Ctenophora Eg.Pleurobrachia **1hr.**

Module III **6hrs**

Phylum - Platyhelminthes

Class 1 :Turbellaria – Dugesia.

Class 2 :Trematoda – Fasciola

Class 3 :Cestoda – Taenia solium

Phylum- Nematoda

Class 1 Phasmidia - Wuchereria

Class 2:Aphasmidia – Enterobius

General Topic: Human Parasitic nematods :*Ascaris,Ancylostoma,Trichuris,*

Phylum- Annelida

Class 1 : Polychaeta - *Neanthes*

Class 2 : Oligochaeta – Earthworm – *Pheretima*

Class 3 : Hirudinomorpha – *Hirudinaria*

General topic: Parasitic adaptations of leech.

Module IV **8hrs**

Phylum – Arthropoda

Type - Prawn – *Penaeus*

Classification up to class:

Class 1: Merostoma (eg: *Limulus*)

Class 2: Arachnida (eg: Spider)

Class 3: Pycnogonida (eg: *Nymphon*)

Class 4: Crustacea (eg: *Daphnia*)

Class 5: Chilopoda (eg: *Centipede*)

Class 6: Symphyla (eg: *Scutigerella*)

Class 7: Diplopoda (eg: Millipede)

Class 8: Pauropoda (eg: *Pauropus*)

Class 9: Insecta (eg: butterfly)

(Detailed account of examples are not necessary)

Insect pests

1. I Pests of coconut – *Oryctes rhinoceros, Rhynchophorus ferrugineus, Opisina arenosella Eriophid mite*
2. Pests of paddy – *Leptocorisa acuta, Spodoptera mauritius*
3. Pests of stored grains - *Trogoderma granarium, Tribolium castaneum, Sitophilus oryzae*

Module: V **8 hrs**

Phylum – Mollusca (Salient features and classification up to classes) **4hrs**

Class 1. Apalcophora – Neomenia

Class 2. Monoplacophora – Neopalina

Class 3. Bivalvia – Perna

Class 4. Polyplacophora – Chiton

Class 5. Gastropoda – Pila

Class 6. Cephalopoda – Sepia

Class 7. Scaphopoda – Dentalium

Phylum – Echinodermata **3hrs**

Class 1. Asteroidea – Astropecten

Class 2. Ophiuroidea - Ophiothrix

Class 3. Echinoidea – Echinus

Class 4. Holothuroidea – Cucumaria

Class 5. Crinoidea – Antedon

Phylum – Hemichordata **1hr.**

Eg : Balanoglossus.

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SEMESTER I

PROGRAMME: B.Sc. ZOOLOGY

COMPLEMENTARY COURSE: 1 COURSE CODE: ZOOICMP01

COURSE TITLE: ANIMAL DIVERSITY – NON CHORDATA

Module	**Hrs Alloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	7	2	1	-	3
2	7	3	2	1	6
3	6	3	2	1	6
4	8	2	2	2	6
5	8	2	2	-	4
Total	36	12	9	4	25

B.Sc. DEGREE (C.B.C.S.) EXAMINATION,

FIRST SEMESTER – COMPLEMENTARY COURSE FOR BOTANY

ZOO1CMP01 - ANIMAL DIVERSITY – NON CHORDATA

Time: 3 hours **Total Marks: 60**

PART A

Answer **any 10** questions. Each question carries 1 mark

1. Name the causative organism of Filariasis?
2. Why is *Entamoebahistolytica* known as a monogenetic parasite?
3. What is 'red tide'?
4. What is clitellum.
5. Mention the larva of Nereis
6. Assign the following to the respective phyla: a] *Plasmodium vivax* b] *Nosema*
7. Write the habitat of a] *Taeniasolium* b] *Planaria*
8. What is Aristotle's lantern?
9. Give the scientific name any one pest of paddy
10. Write on the symmetry in star fish.
11. Classify Rhopalura.
12. How do the following organisms perform locomotion. a] *Actinophrys* b] *Euglena* c] *Amoeba* d] *Paramecium.*

[10x1 = 10 Marks]

PART B

Answer any **six** questions. Each question carries 5 marks

13. Larval forms of Platyhelminths .
14. How *Hirudinaria* is adapted for a parasitic mode of life?
15. Salient features of phylum Echinodermata.

16. Thoracic appendages of prawn. Draw diagrams.
17. Phylogenetic significance of *Peripatus*.
18. Justify the inclusion of *Balanoglossus* under Hemichordata?
19. Comment on five kingdom classification
20. Describe briefly the pathogenic protozoans.
21. Excretory organs of *Penaeus*.

[6x5 = 30 Marks]

PART C

Answer any two questions. Each question carries 15 marks

22. Enumerate the phyla coming under Kingdom Protista. Give examples for each phyla.
23. Classify phylum Mollusca up to classes, giving the salient features of each class?
24. With suitable illustrations, describe the cephalic appendages of *Penaeus*?
25. What do you mean by a coral reef? Substantiate the statement 'A coral reef is a complex living community'. **(2x10 = 20 Marks]**

Semester I

COMPLEMENTARY COURSE BOTANY-I

PRACTICAL I

ZOO1CMP01(P) ANIMAL DIVERSITY – NON CHORDATA

36 hrs **Credit 1**

1. **Scientific drawing**: 5 specimens
2. **Simple identification**: 20 invertebrates (Out of which 10 by their scientific names)
3. **Histology:** T.S of Earthworm, T.S of *Fasciola*
4. **Dissections:** Prawn Nervous system, Cockroach Nervous system
5. **Mounting** – Prawn Appendages, Cockroach Mouth parts

Field Work: Collection and identification of pests of crop plants & stored products

Semester II

COMPLEMENTARY COURSE BOTANY-II

ZOO2CMP02- ANIMAL DIVERSITY – CHORDATA

36 hrs Credit 2

Objectives

1. To develop an aptitude for understanding nature and its rich biodiversity.
2. To acquire knowledge on the taxonomic status of the various vertebrate animals and animal groups.
3. To familiarise the students with the diverse groups of organisms in and around.
4. To understand how each group is related to those above and below.
5. To learn the physiological and anatomical peculiarities through type study.

Course Outcomes

1. Acquire knowledge on the taxonomic status of the various vertebrate animals and animal groups.
2. Familiarise the students with the diverse groups of vertyebrates and their evolutionary changes.
3. Better understanding of rich biodiversity of nature and their role on earth.
4. Apply the knowledge to identify the animals coming across
5. Inculcate curiosity to know the animal world along with plants

Module I **8hrs.**

Phylum Chordata - General characters, Classification upto classes

Sub phylum I Urochordata

Class 1. Larvacea eg . Oikopleura

Class 2. Ascidiacea eg. Ascidia

Class 3. Thaliacea eg. Salpa

Subphylum II Cephalochordata

Eg. Brachiostoma (Amphioxus) Mention the significance and affinities.

Subphylum III Vertebrata

Division I Agnatha

Class Cyclostomata eg. Petreromyzon

Division 2 Gnathostomata

Super class 1. Pisces

Super class 2. Tetrapoda

Module II **4hrs.**

Super class Pisces

Class 1. Chondrichthyes . Eg:,,Scoliodon ,Narcine

Class 2: Osteichthyes. Sardine, Mackeral, Mullet, Clarius etc

General Topic: Accessory respiratory organs in fishes

Module III **14 hrs**

Super Class Tetrapoda

Class : Amphibia **10hrs**

Type : *Euphlyctis hexadactylus*

Order I. Urodela eg. *Amblystoma* (Mention Axolotl larva and Neoteny)

Order II. Anura eg. *Duttaphrynus melanostictus*

Order III . Apoda eg. *Icthyophis*

Class : Reptilia **4hrs**

Sub class I: Anapsida Eg. *Chelone, Crocodiles.*

Sub class II Diapsida Eg. *Chameleon, Calotes*

Subclass III Parapsida Eg. *Icthyosaurus*

Subclass IV Synapsida Eg. *Cynognathus* .

General Topic: Identification of Poisonous and non-poisonous snakes of Kerala

Module IV **4hrs**

Class Aves- General characters (Mention common names and scientific names of examples).

Sub class I : Archaeornithes Eg: Archaeopteryx (Significance).

Sub class II. Neornithes Eg: Struthio, Kiwi, emu. Pigeon, Peacock, Crow, koel.

General Topic: Flight adaptations of birds.

Module V

Class – Mammalia **6 hrs**

Sub class I Prototheria eg. Echidna

Sub Class II Metatheria eg. Macropus

Sub class III Eutheria eg. Elephas, Pteropus, Armadillo, Porcupine , Dugong, Oryctolagus , Dolphin.

General Topic: Aquatic mammals and their adaptations.

REFERENCES

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M. Ekambaranatha Ayyar, 1973: A manual of zoology. Part II. (S. Viswanathan Pvt. Ltd., Madras).

E.L. Jordan & P.S. Verma, 1998 :Chordate zoology. (S. Chand & Co.). 1092 pages.

Gurdarshan Singh & H. Bhaskar, 2002: Advanced Chordate Zoology. Campus Books, 6 Vols., 1573 pp.,

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SEMESTER II

COMPLEMENTARY COURSE FOR BOTANY

ZOO2CMP02 : ANIMAL DIVERSITY – CHORDATA

Module	**Hrs Alloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	8	2	1	-	3
2	4	1	1	1	3
3	14	5	4	1	10
4	4	2	1	1	4
5	6	2	2	1	5
Total	36	12	9	4	25

B.Sc. DEGREE COMPLEMENTARY (CBCSS) EXAMINATION
MODEL I- SEMESTER II
ZOO2CMP02- ANIMAL DIVERSITY- CHORDATA

Time: 3 Hrs **Max.Marks: 60**

PART – A

Answer any 10 questions. Each question carries 1 mark.

1. Systematic position of *Amphioxus* .
2. Give an example for Agnatha.
3. Mention the class to which *Narcine* belongs.
4. Which are the subclasses of class Reptilia.
5. What is *os innominatum* .
6. Notes on *Icthyophis.*
7. What is diastema?
8. Name two non poisonous snakes of Kerala.
9. Give two examples for Neornithes.
10. What are marsupials.
11. Adaptations of *Draco.*
12. Significance of *Archaeopteryx.* **(10 x 1 = 10 Marks**)

PART- B

Answer any 6 of the following. Each question carries 5 marks

13. Compare Chondrychthyes with Osteichthyes.
14. What is a living fossil? Give an example.
15. How will you identify a Cobra from a Viper?
16. General characters of class Aves.
17. Classify amphibian upto orders giving examples .
18. What is a portal system? Give an example.
19. Describe the structure of integument in frog.
20. What is retrogressive metamorphosis?
21. Differentiate Perissodactyla from Artiodactyla. **(6 x 5= 30Marks)**

PART- C

Answer any 2 of the following . Each question carries 10 marks

22. Write an essay on accessory respiratory organs in fishes.
23. Explain how the birds are adapted for flight.
24. Describe the structure of mammalian heart. Add a note on circulation.
25. Describe the structure of brain in frog. Name the 10 pairs of cranial nerves.

(**10x 2=20 Marks)**

SEMESTER II

COMPLEMENTARY COURSE BOTANY-II

PRACTICAL II

ZOO2CMP02 (P) - ANIMAL DIVERSITY – CHORDATA

36 hrs **Credit 1**

1. Morphology – **Scientific drawing**: 5 specimens of chordates

2. **Simple identification**: 10 chordates (Out of which 5 by their scientific names)

3. **Osteology**: Vertebrae and girdles of Frog

4. Snake identification - 3 poisonous and 3 non poisonous with key

5. **Mounting:** Placoid scales of shark, ctenoid and cycloid scales .

6. **Dissections Frog**: Photographs/Diagrams/one dissected & preserved specimen each/ models may be used for the study.

1. Frog – Viscera

2. Frog – Digestive System

3. Frog – Arterial System

4. Frog – Sciatic plexus

5. Frog – Brain

Semester –III

COMPLEMENTARY COURSE BOTANY-III

ZOO3CMP03 - HUMAN PHYSIOLOGY AND IMMUNOLOGY

54 hrs **Credit .3**

Objectives

1. To inspire the students in learning the frontier areas of biological sciences.
2. To connect the functions of organs to its structure.
3. To understand the cause of common diseases.
4. To help them learn the need of healthy lifestyle.
5. To learn the action of hormones and related disorders.

Outcomes

1. Develop a holistic understanding of the complex physiological systems of body through lectures, practical and laboratory exercise, assignment and seminars.
2. Understand the correlation between structure and function of organisms
3. Make them aware of the health related problems, their origin and treatment.
4. Provide an in depth knowledge in nutrition,respiration,circulation ,excretion Neuro and muscle physiology and endocrine organs and disorders affecting these organ
5. Understand the role of immunology on human health and well-being.
6. Familiarize different immune response system, immune disorders and new developments in immunology

UNIT I HUMAN PHYSIOLOGY **36 hrs**

Module I

Nutrition: Outline classification of food components: (Carbohydrates, Lipids, Proteins, Vitamines, Minerals and trace elements), Malnutrition disorders, Vitamin deficiencies, and mineral deficiencies (Iron, Calcium and Iodine)

3hrs

Respiration: Transport of O_2 and CO_2 in blood, respiratory disorders – Dyspnoea, Hypoxia, Asphyxia, Hypo and Hypercapnia, CO poisoning, smoking and its physiological effects.

5hrs

Circulation: Blood – Composition and function, Brief account of mechanism of blood clotting; Disorders of blood clotting – Haemophilia, cerebral and pulmonary thrombosis, Cerebral haemorrhage, Blood pressure and factors controlling it; electrocardiogram, Cardiovascular disorders – Arteriosclerosis, Myocardial infarction, Angiogram and Angioplasty.

7hrs

Module II

Excretion: Structure of human nephron, composition of urine – normal and abnormal constituents, urine formation (ultra filtration , selective reabsorption, tubular secretion and counter current mechanism); Hormonal control of renal function, Kidney disorders – myeleonephritis, glomerular nephritis, nephrotic syndrome, kidney stone, Dialysis.

6hrs

Neurophysiology: Structure of typical neuron, myelenated and non myelenated nerve fibres; Nerve impulse – initiation and propagation of nerve impulse, All or none law, Saltatory conduction, Synapse- types, Synaptic transmission, Neurotransmitters, Brain waves, Electroencephalogram, Neural disorders – Parkinson's disease, Epilepsy, Alzheimier's syndrome, Dyslexia, Schizophrenia.

6hrs

Module III

Muscle Physiology: Striated, Non-striated and Cardiac muscle, Ultra structure of striated muscle fibre, Mechanism of muscle contraction, Threshold and spike potential, Fatigue, O_2 debt, Rigor mortis. **4hrs**

Endocrinology: Endocrine glands and their hormones, mode of action (in brief), Hypothalamus, Pituitary , Thyroid, Parathyroid, Thymus , Islets of Langerhans, Adrenal, Testis and ovary , Feed back mechanism.Hormonal disorders**.** **5hrs**

UNIT II IMMUNOLOGY **18hrs**

Module IV

Introduction to immunology. Types of immunity- innate immunity , acquired, passive and active. Mechanism of innate immunity (eg. Barriers , phagocytosis , inflammation)

3hrs

Antigens and antibodies: Types of antigens, Properties of antigens, haptens, epitopes, adjuvants, antigenic determinants. Basic structure of immunoglobulins, Different classes of immunoglobulins and functions.

5hrs

ModuleV Immune response system : Primary and secondary lymphoid organs, Cells of Immune system – T & B lymphocytes, Macrophages, Plasma cells , Memory cells, MHC, Antibody synthesis, Hybridoma technology (Brief account only) - Monoclonal antibodies and its application **5hrs**

Immune disorders – Hypersensitivity, Auto immunity & Immunodeficiency and AIDS.

Antigen antibody reactions: Precipitation test and agglutination test. Clinical applications of antigen antibody reactions: Widal, VDRL, HIV test (ELISA), Complement Fixation Test, and Coombs test.

Vaccines: Major types of vaccines (BCG, DPT, Polio vaccine and TAB vaccines). Recent trends in vaccine preparation. Mention two vaccine preparing centres in India**.**

5hrs

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Guyton : Text Book of Medical Physiology Saunders

Sarada Subramanyam & K. Madhavankutty : Textbook of human physiology, S. Chand & Co Joshi : Nutrition and Dietetics , Tata Mc. Graw HillLtd, New Delhi.

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SEMESTER III

COMPLEMENTARY COURSE 3 FOR BOTANY:

COURSE CODE: ZOO3CMP 03

MODULE	HRS ALLOTED	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	TOTAL QUESTIONS
1	15	3	2	1	6
2	12	2	3	1	6
3	9	2	2	-	4
4	13	3	2	1	6
5	5	2	-	1	3
Total	54	12	9	4	25

COMPLEMENTARY COURSE BOTANY-III

ZOO3CMP03 - HUMAN PHYSIOLOGY AND IMMUNOLOGY

Time 3hrs **Marks 60**

PART-A

Answer any 10 questions. Each question carries 1 mark

1. What is Bohr effect ?
2. MHC
3. What is Rigor mortis?
4. Define Antigen
5. What is Haemodialysis.
6. Explain Myocardial infarction.
7. Mention the function of calcitonin .
8. What is dyslexia.
9. Define Hapten.
10. What is phagocytosis.
11. Iron and iodine deficiency in body causes?
12. Mention two vaccine preparing centres in India. **(10x1=10marks)**

PART- B

Answer any 6 questions. Each question carries 5 marks

13. Explain the physiology of muscle contraction.
14. Briefly explain ELISA test.
15. Explain structure of neuron with diagram.
16. Counter current mechanism of urine formation.
17. Explain the structure of immunoglobulin.
18. Explain the mechanism of blood coagulation.
19. Explain the hormonal control of kidney function.
20. Give an account of CO_2 transport by blood.
21. Differentiate between cretinism and myxedima **(6x5=30 marks)**

PART C

Answer any 2 questions. Each question carries 10 marks

22. Write an essay on the composition and function of blood.
23. Explain generation of nerve impulse and transmission. Add a note on all or none response.
24. Write an essay on cells of immune system. Mention monoclonal antibodies and its application.
25. Write an essay on the clinical applications of antigen antibody reaction.

(2x10 = 20marks)

SEMESTER III

COMPLEMENTARY COURSE BOTANY-III

PRACTICAL III

ZOO3CMP03 (P) HUMAN PHYSIOLOGY AND IMMUNOLOGY

36hrs **Credit 1**

1.Preparation of Human Blood smear & identification of leucocytes
2.Qualitative analysis of Reducing Sugar, Protein and Lipid
3.Acion of Salivary amylase on Starch (Demonstration Only)
4.Estimation of Haemoglobin (Demonstration only)
5.Identification of human blood groups, A, AB, B and O, Rh factor
6.Instruments (Principle & use)Sphygmomanometer, Stethoscope , Measurement of blood pressure using Sphygmomanometer (demonstration)

SEMESTER IV

COMPLEMENTARY COURSE BOTANY-IV

ZOO4CMP04 -APPLIED ZOOLOGY (AQUACULTURE, SERICULTURE, VERMICULTURE AND APICULTURE)

54 hrs **Credit 3**

Objectives

1. To Create interest in the applied branches of zoology.
2. To inculcate a positive attitude towards the conservation of natural habitats.
3. To aquaint with rearing species of honey bees, earthworms, silk worms etc.
4. To make them students aware of the requirements and methods to set up an aquarium.
5. To give them an idea of various methods of aquaculture.

Course outcomes

1. Able to understand the economic importance of biodiversity.
2. Understand the significances of natural water bodies as a means of livelihood for local communities
3. A shift from inorganic fertilizers to organic fertilizers will occur.
4. Aware of proper disposal of waste without affecting the normal parameters of soil and water.
5. Equip the students with skills and knowledge which can lead to self-employment opportunities.

Module I 18 hrs

Aquaculture : Traditional methods of aquaculture, Advantages and salient features of aquaculture, Types of aquaculture, Biotic and abiotic factors of water, Importance of Algae in aquaculture, Common Cultivable fishes of Kerala, Pond culture (Construction and maintenance) Brief Description of Carp culture ,Composite fish culture. Integrated Fish Culture, Induced breeding in fishes, Important Fish Diseases. Fish preservation and processing.

Aquarium management: Setting up of an Aquarium, Biological filter and Aeration. Common species of Aquarium fishes.

Module II

Prawn culture, Mussel culture, Pearl culture **6 hrs**

Module III **12 hrs**

Sericulture: Four species of silkworms, Life history of silkworms, Silkworm Rearing Techniques. Mounting of worms. Harvesting and stifling of cocoons. Diseases and Pests of silkworms, Silkworm diseases. Preventive and control measures. Mention 2 sericulture institutes.

Module IV **6 hrs.**

Vermiculture: Species of Earthworms suitable for vermiculture.Ecological classification of earthworms. Life Cycle and reproduction of earthworms. Physical and Chemical effects of Vermiculture(Earthworms on soil), Vermicomposting, Site Selection,Preparation of pit Cement pit Soil pit .Maintenance and Monitoring.

ModuleIV **12 hrs**

Apiculture: Species of Honey bees. Organization of honeybee colony. Bee keeping methods and equipments. Apiary management and maintenance. Bee pasturage, Byproducts of honey bees and their uses. Diseases and pests of honey bees, control measures. Melipony Culture.

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Menon, K.N., 1970: Malsyakrishi (State Institute of language, Trivandrum)Singh, S., 1962 Bee keeping in India (ICAR, New Delhi)

Edwards, C.A. & Lafty, J.R. 1972: Biology of Earthworms (Chapman and Hall Led. London)

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SEMESTER IV

COMPLEMENTARY COURSE FOR BOTANY

COURSE CODE ZOO4CMP04 -APPLIED ZOOLOGY

(AQUACULTURE, SERICULTURE, VERMICULTURE AND APICULTURE)

Module	**HrsAlloted**	**Part A** 1 Mark 10/12	**Part B** 5 Marks 6/9	**Part C** 10 Marks 2/4	**Total questions**
1	18	4	3	1	8
2	6	2	2		4
3	12	2	2	1	5
4	6	2		1	3
5	12	2	2	1	5
Total	54	12	9	4	25

COMPLEMENTARY COURSE BOTANY-IV
ZOO4CMP04 -APPLIED ZOOLOGY
(AQUACULTURE, SERICULTURE, VERMICULTURE AND APICULTURE

Time 3 hours **Maximum Mark 60**

PART A
Answer any 10 questions. Each question carries 1 mark.

1. Composite fish culture.
2. Write the scientific names of any two aquarium fishes.
3. What is the causative organism of fin rot disease in fishes?
4. Comment on biological filters.
5. Give the features of *Pinctada vulgaris*.
6. What is eye stalk ablation method?
7. Comment on Uzi fly
8 . What is the use of Chandrika in sericulture?
9. Give the name of any one earthworm species used in vermiculture.
10. Comment on vermicomposting.
11. What is bee pasturage?
12. Give the features of *Apis cerena indica.* **(10x1=10marks)**

PART B

Answer any 6 questions. Each question carries 5 marks

13. Briefly describe common cultivable fishes in Kerala.
14. Explain induced breeding in fishes.
15. Describe the steps involved in the setting up of an aquarium.
16. Briefly describe mussel culture.

17. Describe the process of pearl culture.
18. Describe the species used in sericulture.
19. Write a short account on silkworm rearing techniques.
20. Briefly describe the social organization of honey bee.
21. Comment on the biological and chemical nature of honey. **(6x5=30 marks)**

PART C

Answer any two questions . Each question carries 10 mark

22. Write an essay on fish preservation and processing techniques.
23. Elaborate the diseases and pests of sericulture.
24. Describe the process of vermiculture.
25. Discuss bee keeping methods and equipments. **(2x10=20 marks)**

COMPLEMENTARY COURSE BOTANY-IV

PRACTICAL IV

ZOO4CMP04 (P) - APPLIED, ZOOLOGY

(AQUACULTURE, SERICULTURE VERMICULTURE, APICULTURE)

36 hrs Credit 1

1. General Identification, Economic importance, Morphology, scientific names and common names of the following

- Economic important and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, Etroplus, Tilapia)
- Two species of earthworms used in Vermiculture
- Two species of honey bees including stingless bee
- Silkworm. Cocoon/Adult

2. Fish Parasites (Any one). Castes of bees

3. Bee keeping equipments Beehive, Smoker, honey extractor

4. Beeswax, Honey, Silk, Vermicompost (Identification-Uses)

5. Chandrika /Natrika used in sericulture

6. Fish diseases (Any two diagrams /specimens).

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