SACRED HEART COLLEGE (AUTONOMOUS), THEVARA

KOCHI, KERALA, 682013

CURRICULUM AND SYLLABUS

FOR

B.Sc. ZOOLOGY

CHOICE BASED CREDIT AND SEMESTER SYSTEM (CBCSS)

INTRODUCED FROM 2023 ADMISSIONS ONWARDS

Prepared By
Board of Studies in Zoology
Sacred Heart College (Autonomous)
Thevara, Kochi

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1. INTRODUCTION

Science and scientific literacy play a key role in educating citizens of today for the world tomorrow. Critical to succeeding in this endeavour are the core competencies that provide students with the ability to think critically, solve problems, and make ethical decisions; to communicate their questions, express opinions, and challenge ideas in a scientifically literate way; and to exercise an awareness oftheir role as an ecologically literate citizenry, engaged and competent in meeting the responsibilities of caring for living things and the planet.

Zoology (also known as animal science) is the branch of biology devoted to the study of animal life. It is multidisciplinary in nature, involving study of organisms and their genetic, morphological and physiological attributes, their surrounding environment, and their role in conservation of environment. Zoology is a combination of various disciplines such as Genetics, Physiology, Ecology, Developmental Biology, Microbiology, Entomology, Evolution, Taxonomy, Fisheries, Wildlife Biology, Bioinformatics, Biotechnology, Biostatistics etc. This subject has significant role in human resource development, food security, environmental conservation, sustainable development and alleviation of poverty.

The creation of a scientific thinking and scientific attitude necessitates proper education and guidance. In order to achieve this, one must update the developments in every field of science. An effective science education can be imparted at the undergraduate level only by constantly updating the existingcurriculum. The present undergraduate curriculum in Zoology was revised in 2015 after the college was elevated to 'Autonomous' status in 2014. The Board of Studies in Zoology then revised the curriculum in tune with the parent University and the University Grants Commission's model for Under Graduate Curriculum. In this process care has been taken to give emphasis to various aspects such as the creativity of students, knowledge of current developments in the discipline, awareness of environmental impacts due to the development of science and technology, the skills essential for handling equipment and instruments in laboratories and industries, employability and entrepreneur development. Later, consequent of the Hon'ble Supreme Court of India order and the subsequent UGC circular, the Academic Council of the college decided to incorporate Environmental Studies and Human Rights in the UG curriculum, as an additional core course. The syllabus was revised accordingly in 2019.

The meeting of the Board of Studies in Zoology held on 25th February 2022 decided to revise the existing UG Zoology Syllabus and the following recommendations were made to be considered while revising the syllabus: Include topics that are in that are in tune with the emerging national and global trends and relevant to the local needs; Include topics that addresses cross-cutting issues such as Professional Ethics, Gender Equality, Human Values, Environment and Sustainability etc.; Include Courses/topics that enhances the employability of students; Explore the possibility of inclusion of more Virtual Practicals in the practical courses. The syllabus was revised based on these recommendations and BoS approved the syllabus in its meeting held on 15th July 2022. The

Academic Council of the college decided to implement the revised syllabus **(**B.Sc. Zoology Core and Complementary programmes**)** with effect from the academic year 2023-24.

PROGRAME OUTCOMES

PO1 Critical Thinking & Deep Domain Knowledge

PO2 Effective Communication

PO3 Contribute to Nation Building

PO4 Care for the Environment

PO5 Ethical Values

PO6 Global Perspective

PROGRAMME SPECIFIC OUTCOMES

After the completion of the programme the student would

PSO1	Enumerate the faunal diversity through scientific classification and explain the complex interactions among animals and environment.
PSO2	Explain the principles of aquaculture, sericulture, apiculture, vermiculture, poultry and cattle farming
PSO3	Analyze the concepts and principles of various branches of Zoology, and effectively communicate their different applications to society.
PSO4	Evaluate the standard protocols and ethics of laboratory experiments in various branches of Zoology.
PSO5	Conduct independent fieldwork/laboratory experiments and extend the knowledge to society.

ELIGIBILITY

Eligibility for Admissions: Pass in +2 Examination with Biology as an optional subject

Medium of Instruction and Assessment: English

Faculty under which the Degree is Awarded: Science

Complementary Courses offered: Chemistry and Botany

2. REGULATIONS FOR CHOICE BASED CREDIT AND SEMESTER SYSTEM (CBCSS) FOR UNDER GRADUATE PROGRAMMES -2023

Preamble

Sacred Heart College, Thevara became an autonomous college under Mahatma University Kottayam in 2014. Since then, academic programmes of the college are being conducted as per the curriculum and syllabus approved by the various Boards of studies and the academic council of the college. The college revised the syllabi of the under graduate(UG) programmes in 2015-16 and 2019-20. The curriculum and syllabus under the choice based credit and semester system (CBCSS) for the under graduate programmes effective from 2019-20 admissions offer Outcome Based Education (OBE). The new 'REGULATIONS FOR CHOICE BASED CREDIT AND SEMESTER SYSTEM (CBCSS) FOR UNDER GRADUATE PROGRAMMES -2023' is a continuation of the effort of the college for providing best education to the UG students of the college.

2.1 Title

These regulations shall be called **"SACRED HEART COLLEGE THEVARA REGULATIONS FOR CHOICE BASED CREDIT AND SEMESTER SYSTEM (CBCSS) FOR UNDER GRADUATE PROGRAMMES -2023**

2.2 Scope

Applicable to all under graduate (UG) programmes of the college with effect from 2023 admissions onwards, except otherwise approved by the Academic Council of the College

2.3. Definitions

i. '**Programme**' means the entire course of study and examinations.
ii. 'Duration **of Programme'** means the period of time required for the conduct of the programme. The duration of under graduate programmes shall be 6 semesters, post-graduate programme shall be of 4 semesters and M Phil programmes shall be 2 semesters.
iii. **'Semester'** means a term consisting of a minimum of 90 working days, inclusive of examination, distributed over a minimum of 18 weeks of 5 working days, each with 5 contact hours of one hour duration
iv. **'Course'** means a segment of subject matter to be covered in a semester. Each Course is to be designed variously under lectures / tutorials / laboratory or fieldwork / study tour /seminar / project / practical training / assignments/evaluation etc., to meet effective teaching and learning needs.

v. '**Common Course I'** means a course that comes under the category of courses for English and '**Common Course II**' means additional language, a selection of both is compulsory for all students undergoing undergraduate programmes(Model I)

vi. '**Core course'** means a course in the subject of specialization within a degree programme.

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

viii. '**Open course'** means a course outside the field of his/her specialization, which can be opted by a student.

ix. '**Additional core course**' means a compulsory course for all under graduate students (as per the UGC directive) to enrich their general awareness.

x. The U.G. programmes shall include (a) Common courses (b) Core courses (c) Complementary Courses (d) Open Course (e) Study tour and (f) Internship for selected programmes.

xi. '**Additional Course'** is a course registered by a student over and above the minimum required courses.

xii. **'Credit' (Cr)** of a course is the numerical value assigned to a course according to the relative importance of the content of the syllabus of the programme.

xiii. '**Extra credits**' are additional credits awarded to a student over and above the minimum credits required for a programme for achievements in co-curricular activities carried out outside the regular class hours OR curricular activities/courses completed for value addition, as directed by the College/ department. It is the numerical value assigned to Club activities, Social service, Internship, add on courses etc. which is not added with the total academic credits of the students. Additional credit components

   (a) Talent & career club activity (optional)
   (b) Social service (mandatory)
   (c) Internship for Commerce, Communication and Computer applications (mandatory).
   (d) Internship (desirable for other programmes).
   (e) Add on courses (optional)

xiv. '**Programme Credit'** means the total credits of the UG Programme.

xv. **'Programme Elective course'** Programme Elective course means a course, which can be chosen from a list of electives and a minimum number of courses is required to complete the programme.

xvi. '**Programme Project'** Programme Project means a regular project work with stated credits on which the student undergoes a project under the supervision of a teacher in the parent department / any appropriate Institute in order to submit a dissertation on the project work as specified.

xvii. '**Internship**' is on-the-job training for professional careers.

xviii. '**Plagiarism**' Plagiarism is the unreferenced use of other authors' material in dissertations and is a serious academic offence.

xix. '**Tutorial'** Tutorial means a class to provide an opportunity to interact with students at their individual level to identify the strength and weakness of individual students.

xx. '**Seminar'** seminar means a lecture by a student expected to train the student in self-study, collection of relevant matter from the books and Internet resources, editing, document writing, typing and presentation.

xxi. '**Evaluation'** means every course shall be evaluated by 25% continuous (internal) assessment and 75% end course/end semester (external) assessment.

xxii. '**Repeat course'** is a course that is repeated by a student for having failed in that course in an earlier registration.

xxiii. **'Audit Course'** is a course for which no credits are awarded.

xxiv. '**Department'** means any teaching Department offering a course of study approved by the college / Institute as per the Act or Statute of the University.

xxv. '**Parent Department'** means the Department which offers a particular UG/PG programme.

xxvi. '**Department Council'** means the body of all teachers of a Department in a College.

xxvii. **'Faculty Advisor'** is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities undertaken in the Department.

xxviii. '**College Co-ordinator** means a teacher from the college nominated by the College Council to look into the matters relating to CBCSS

xxix. **'Letter Grade'** or simply '**Grade**' in a course is a letter symbol (O, A, B, C, D, etc.) which indicates the broad level of performance of a student in a course.

xxx. Each letter grade is assigned a **'Grade point'** (GP) which is an integer indicating the numerical equivalent of the broad level of performance of a student in a course.

xxxi. **'Credit point'** (CP) of a course is the value obtained by multiplying the grade point (GP) by the Credit (Cr) of the course CP=GP x Cr.

xxxii. '**Semester Grade point average'** (SGPA) is the value obtained by dividing the sum of credit points (CP) obtained by a student in the various courses taken in a semester by the total number of credits taken by him/her in that semester . The grade points shall be rounded off to two decimal places. SGPA determines the overall performance of a student at the end of a semester.

xxxiii. **Cumulative Grade point average'** (CGPA) is the value obtained by dividing the sum of credit points in all the courses taken by the student for the entire programme by the total number of credits and shall be rounded off to two decimal places.

xxxiv. '**Grace Marks'** means marks awarded to course/s, as per the orders issued by the college from time to time, in recognition of meritorious achievements in NCC/NSS/Sports/Arts and cultural activities.

2.4 ATTENDANCE

Being a regular college, physical presence in the regular activities, especially, classes and exams, is mandatory for the students. However, if a student secures 75% of attendance s/he is eligible to appear for the exams, provided there are no other impediments like disciplinary proceedings, malpractice record etc.

i. A maximum of 5 marks (5%) for a course is given for attendance

ii. **Absence:** A student found absent for one hour in the forenoon or afternoon session is deprived of the attendance for the entire session as far as eligibility for final exam is concerned.

iii. The hour related calculation in a course is meant for awarding marks for the course concerned.

iv. **Late entry**: A student is supposed to be in time in the class. Late arrival related treatment is left to the discretion of the individual teacher. However, as a norm, a late arriving student may be permitted to the class, if it is not inconvenient or distraction to the class as such; though attendance MAY NOT BE GIVEN. Late arrival beyond 5 minutes is treated as ABSENCE; though the teacher may consider permitting the student to sit in the class.

v. **Leave** : A student has to formally report his/her absence with reasons either in advance, or immediately after the absence for obtaining an approved leave. This applies to all sorts of leave – medical, on duty or other.

vi. The student is supposed to report in prescribed format on the very next day of the absence; however, upto a week's time is permitted. Afterwards, the leave applications will not be considered.

vii. The student has to retain a copy/section of the approved leave form and produce the same as proof, in case there is any confusion regarding the leave sanctioning. In the absence of such proof, the claims will not be entertained.

viii. **Duty Leave**: A student representing the college in sports, arts, social service or academic matters, has to get sanction from the class teacher concerned and submit the leave application form duly endorsed by teacher concerned & the class teacher, and submit it to the faculty Dean (or Vice Principal). The same will be forwarded by the Dean/Vice Principal for attendance entry. **SPORTS**: The approval of the Department of Physical Education and the class teacher is required. The time limit for submission mentioned above is applicable in the case of duty leave as well.

ix. **CONDONATION**: a student may have the privilege of condonation of attendance shortage (upto a maximum of 10 days) on the basis of genuineness of the grounds of absence (medical reasons or college duty), duly recommended by the department. This is not a matter of right. It is a matter of privilege based on Principal's discretion and the good conduct of the student on the campus. A student of UG programme may have a maximum of two such opportunities.

x. **RE-ADMISSION** – a student whose attendance is inadequate will have to discontinue the studies. Such students, whose conduct is good, may be re-admitted with the approval of Governing Body, on the basis of recommendation from the department, and assurance from the student and the guardian regarding good conduct and compliance in academic and discipline matters. For this the prescribed re-admission fee has to be paid.

As a condition for re-admission, the student should have cleared all academic arrears, or should have appeared for the exams in which he/she is having an arrear (if the results are not out), and should have fulfilled all academic assignments prescribed by the department for compensating for his lack of attendance.

xi. **UNAUTHORISED ABSENCE & REMOVAL FROM ROLLS**: A student absent from the classes continuously for 10 consequent days without intimation or permission, shall be removed from the rolls, and the matter intimated to the student concerned. On the basis of

recommendation of the department concerned, re-admission process may be permitted by the Principal.

2.5 PROGRAMME REGISTRATION

i. A student shall be permitted to register for the programme at the time of admission.

ii. A UG student who registered for the programme shall complete the same within a period of 12 continuous semesters from the date of commencement of the programme.

2.6 PROMOTION: A student who registers for the end semester examination shall be promoted to the next semester. However, in extreme circumstances, a student having sufficient attendance who could not register for the end semester examination may be allowed to register notionally by the Principal with the recommendation of the Head of the department concerned and , by paying the prescribed fee.

2.7 UNDER GRADUATE PROGRAMME STRUCTURE

Model I 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 *(English)*	22
d	Credits required from Common Course *II (Additional Language)*	16
e	Credits required from Core course and Complementary courses including Project	79
f	Open Course	3
g	Minimum attendance required	75%

2.7.1. DURATION OF THE PROGRAMME

The duration of U.G. programmes shall be 6 semesters The duration of odd semesters shall be from June to October and that of even semesters from November to March. A student may be permitted to complete the Programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

2.7.2. COURSE DESIGN

The UG programme in Zoology consists of the following types of courses:

a) Common courses.

b) Core courses.

c) Complementary courses.

d) Open courses.

e) Choice based courses.

f) Project

The core course is in the discipline of Zoology and two complementary courses, in Chemisty and Botany. The student shall select any one open course in Sem V offered by otherdepartments includingDepartment of Physical Education.

2.7.3. PROGRAMME STRUCTURE

2.7.3.1. *Course-wise Distribution of Credits:*

The B. Sc. Zoology programme consists of common courses with 38 credits, core course, Choice based course and complementary courses with 79 credits and open course with 3 credits.

The number and credits of different types of courses of the programme are listed below.

Type of the Course	No. of Courses	No. of Credits
Common Course I (*English*)	6	22
Common Course II (*Second Language*)	4	16
Total	**10**	**38**
Core Courses – *Theory*	12	34
Core Courses – *Practical*	6	12
Elective course	1	3
Project& Viva – Voce	1	2
Total	**20**	**51**

Complementary Courses – *Theory*	8	20
Complementary Courses – *Practical*	4	8
Total	**12**	**28**
Open Course	1	3
Grand Total	**43**	**120**

2.7.3.2. ***Extra-Credit Courses:***

The list of extra-credit courses and their corresponding credits are given below:

Course	No. of Credits
Service-Learning (*Mandatory*)	1
Courses offered by talent clubs	1
Animal Rearing Programmes	1
Virtual lab Experiments	1
Certificate Course in Faunal Identification	2

2.7.3.3. ***Semester-wise Distribution of Credits and Instructional Hours*** **for Core Courses**

Course Code	Course Title	Credits	Hours / Week	Hour / Sem.	Examination		
					ESE *Duration*	**ESE** *Max. Marks*	**CIA** *Max. Marks*
SEMESTER I							
23U1CRZOO01	Animal Diversity - Non-Chordata I	2	2	36	3 Hrs.	60	20
23U2PRZOO01	Practical 1 -Animal Diversity - Non-Chordata I & II	-	2	36	*Examination at the end of Sem II*		
SEMESTER II							
23U2CRZOO02	Animal Diversity - Non-Chordata II	2	2	36	3 Hrs.	60	20
23U2PRZOO01	Practical 1 -Animal Diversity - Non-Chordata I & II	2	2	36	3 Hrs.	30	10
SEMESTER III							
23U3CRZOO03	Animal Diversity - Chordata	3	3	54	3 Hrs.	60	20

23U4PRZOO02	Practical 2 -Animal Diversity - Chordata + Applied Zoology	-	2	36	*Examination at the end of Sem IV*		
SEMESTER IV							
23U4CRZOO04	Applied Zoology	3	3	54	3 Hrs.	60	20
23U4PRZOO02	Practical 2 -Animal Diversity - Chordata + Applied Zoology	2	2	36	3 Hrs.	30	10
SEMESTER V							
23U5CRZOO05	Cell and Molecular Biology	3	3	54	3 Hrs.	60	20
23U5CRZOO06	Environmental Biology	3	3	54	3 Hrs.	60	20
23U5CRZOO07	Evolution, Zoogeography and Ethology	3	3	36	3 Hrs.	60	20
23U5CRZOO08	Biochemistry, Human Physiology and Endocrinology	3	3	36	3 Hrs.	60	20
23U6PRZOO03	Practical 3 – Environmental Biology, Toxicology and Disaster Management + Evolution, Zoogeography and Ethology	2	2	36	*Examination at the end of Sem VI*		
23U6PRZOO04	Practical 4 – Cell and Molecular Biology + Biochemistry, Human Physiology and Endocrinology	2	2	36	''		
23U6PJZOO01	Project and Viva (6th Semester) Visit to research institutes (6th Semester) Study tour/Field study , Group activity (5th Semester)	-	1	18	*Project evaluation and viva-voce at the end of Sem VI.*		
OPEN COURSE FOR OTHER STREAMS							
23U5OCZOO01	Human Genetics, Nutrition, Community health and Sanitation	3	4	72	3 Hrs.	75	25
SEMESTER VI							
23U6CRZOO09	Reproductive and Developmental Biology	3	3	54	3 Hrs.	60	20
23U6CRZOO10	Genetics and Biotechnology	3	3	54	3 Hrs.	60	20
23U6CRZOO11	Microbiology and Immunology	3	3	54	3 Hrs.	60	20
23U6CRZOO12	General Informatics, Bioinformatics, Biostatistics and Research Methodology	3	3	54	3 Hrs.	60	20
23U6CRZOO13	Ecotourism and Ecotourism Entrepreneurship *(Elective Course)*	3	4	72	3 Hrs.	75	25
23U6PRZOO05	Reproductive and Developmental Biology + Genetics and Biotechnology	2	2	36	3 Hrs.	30	10
23U6PRZOO06	Microbiology and Immunology + General Informatics, Bioinformatics, Biostatistics and Research Methodology	2	2	36	3 Hrs.	30	10
23U6PJZOO01	Project and Viva (6th Semester) Visit to research institutes (6th Semester) Study tour/Field study , Group activity (5th Semester)	2	1	18	*Project evaluation and viva-voce at the end of Sem VI*		

2.7.3.4 *Scheme Of Zoology Complementary Courses For B.Sc. Botany (Semester-Wise Distribution)*

Course Code	Course Title	Credits	Hours / Week	Hour / Sem.	Examination		
					ESE *Duration*	**ESE** *Max. Marks*	**CIA** *Max. Marks*
SEMESTER I							
23U1CPZOO01	Animal Diversity – Non-Chordata	2	2	36	3 Hrs.	60	20
23U2PCZOO01	Practical 1 - Animal Diversity – Non-Chordata + Chordata	-	2	36	*Examination at the end of Sem II*		
SEMESTER II							
23U2CPZOO02	Animal Diversity – Chordata	2	2	36	3 Hrs.	60	20
23U2PCZOO01	Practical 1 - Animal Diversity – Non-Chordata + Chordata	2	2	36	3 Hrs.	30	10
SEMESTER III							
23U3CPZOO03	Human Physiology and Immunology	3	3	54	3 Hrs.	60	20
23U4PCZOO02	Practical 2 - Human Physiology and Immunology + Applied Zoology	-	2	36	*Examination at the end of Sem IV*		
SEMESTER IV							
23U4CPZOO04	Applied Zoology	3	3	54	3 Hrs.	60	20
23U4PCZOO02	Practical 2 - Human Physiology and Immunology + Applied Zoology	-	2	36	3 Hrs.	30	10

2.7.3.5 *Consolidated Scheme*

The programme structure with detailed semester-wise distribution of common courses, core courses, complementary courses, open course, elective course and project are listed below.

Sl. No.	Type of Course	Course Title	Credits	Hrs./ Week	Hrs./ Sem.
SEMESTER I					
1.	Common	English - I	4	5	90
2.	Common	English Common Course - I	3	4	72
3.	Common	Second Language - I (*Mal / Hin / San / Fre*)	4	4	72
4.	Core	Animal Diversity – Non-Chordata I	2	2	36
5.	Core	Practicals 1	-	2	36
6.	Complementary	Chemistry - I	2	2	36
7.	Complementary	Chemistry Practicals - I	-	2	36

8.	Complementary	Botany - I	2	2	36
9.	Complementary	Botany Practicals - I	-	2	36
		Total	**17**	**25**	**450**
		SEMESTER II			
1.	Common	English - II	4	5	90
2.	Common	English Common Course - II	3	4	72
3.	Common	Second Language - II (*Mal / Hin / San / Fre*)	4	4	72
4.	Core	Animal Diversity – Non-Chordata II	2	2	36
5.	Core	Practicals 1	2	2	36
6.	Complementary	Chemistry - 2	2	2	36
7.	Complementary	Chemistry Practicals - I	2	2	36
8.	Complementary	Botany - 2	2	2	36
9.	Complementary	Botany Practicals - I	2	2	36
		Total	**23**	**25**	**450**
		SEMESTER III			
1.	Common	English - III	4	5	90
2.	Common	Second Language - III (*Mal / Hin / San / Fre*)	4	5	90
3.	Core	Animal Diversity – Chordata	3	3	54
4.	Core	Practicals 2	-	2	36
5.	Complementary	Chemistry – III	3	3	54
6.	Complementary	Chemistry Practicals – II	-	2	36
7.	Complementary	Botany - III	3	3	54
8.	Complementary	Botany Practicals – II	-	2	36
		Total	**17**	**25**	**450**
		SEMESTER IV			
1.	Common	English - IV	4	5	90
2.	Common	Second Language - IV (*Mal / Hin / San / Fre*)	4	5	90
3.	Core	Animal Diversity – Applied Zoology	3	3	54
4.	Core	Practicals 2	2	2	36
5.	Complementary	Chemistry – IV	3	3	54
6.	Complementary	Chemistry Practicals – II	2	2	36
7.	Complementary	Botany - IV	3	3	54
8.	Complementary	BotanyPracticals – II	2	2	36
		Total	**23**	**25**	**450**

SEMESTER V					
1.	Core	Cell and Molecular Biology	3	3	54
2.	Core	Environmental Biology	3	3	54
3.	Core	Evolution, Zoogeography and Ethology	3	3	54
4.	Core	Biochemistry, Human Physiology and Endocrinology	3	3	54
5.	Open	Open courses offered in other core subject areas	3	4	72
6.	Core	Practicals III	-	4	72
7.	Core	Practicals IV	-	4	72
8.	Core	Project/Group Activity	-	1	18
		Total	**15**	**25**	**450**
SEMESTER VI					
1.	Core	Reproductive and Developmental Biology	3	3	54
2.	Core	Genetics and Biotechnology	3	3	54
3.	Core	Microbiology and Immunology	3	3	54
4.	Core	General Informatics, Bioinformatics, Biostatistics and Research Methodology	3	3	54
5.	Choice Based	Ecotourism and Ecotourism Entrepreneurship *(Elective Course)*	3	4	72
6.	Core	Practicals III	2	-	-
7.	Core	Practicals IV	2	-	-
6.	Core	Practicals - V	2	4	72
7.	Core	Practicals - VI	2	4	72
8.	Core	Project/Group Activity	2	1	18
		Total	**25**	**25**	**450**

2.8 EXAMINATIONS

All the End Semester Examinations of the college will be conducted by the Controller of Examination. The Principal will be the Chief Controller of Examinations. An Examination committee consists of the Chief Controller of Examinations, Controller of Examinations, Additional Chief Superintendent, Deans, IQAC Coordinator and other faculty members nominated by the Principal will act as an advisory body of the matters relating to the conduct of examinations.

2.9. EVALUATION AND GRADING

The evaluation scheme for each course shall contain two parts;

a. Continuous Internal Evaluation (CIA) and
b. End Semester Examination (ESE).

The internal to external assessment ratio shall be 1:3, for both courses with or without practical except for (i) BA Animation and Graphics (ii) BA Animation and Visual effects and (iii) BBA. For courses without practical, there shall be a maximum of 75 marks for external evaluation and maximum of 25 marks for internal evaluation. For courses with practical, generally external evaluation shall be for a maximum of 60 marks and internal evaluation for 20 marks. Both internal and external evaluation shall be carried out in the mark system and the marks are to be rounded to the nearest integer.

The internal to external assessment ratio for BA Animation and Graphics, BA Animation and Visual effects and BBA shall be decided by the respective Board of studies subject to a minimum of 60 marks for external examinations.

2.9.1. Continuous Internal Assessment (CIA)/ Continuous Assessment: The internal evaluation shall be based on predetermined transparent system involving periodic written tests, assignments, seminars/viva/field survey and attendance in respect of theory courses and based on written tests, lab skill/records/viva and attendance in respect of practical courses. The marks assigned to various components for internal evaluation as follows.

Components of Internal Evaluation (for theory without practical)

	Components	**Marks**
i.	Assignments	5
ii	Seminar/Quiz/Field survey /Viva etc.	5
iii	Attendance	5
iv	Two Test papers(2x5)	10
	Total	25

i. **Assignments**: Every student shall submit one assignment as an internal component for

every course.

Components	Marks
Punctuality	1
Content	2
Conclusion	1
Reference/Review	1
Total	**5**

ii. **Seminar**: The seminar lecture is expected to train the student in self-study, collection of relevant matter from the books and Internet resources, editing, document writing, typing and presentation.

Components	Marks
Content	2
Presentation	2
Reference/Review	1
Total	**5**

iii. Evaluation of Attendance

The attendance of students for each course shall be another component of internal assessment.

% of attendance	Mark
Above 90%	5
Between 85 and below 90	4
Between 80 and below 85	3
Between 76 and below 80	2
Between 75 and below 76	1

Components of Internal Evaluation (for theory with practical)

Components of Theory – Internal Evaluation	Marks
Attendance	5
Seminar/ Assignment (Written assignments, preparation of models, charts, posters etc., field survey, field work)	5
Test paper(s)	10
Total	20

Components of Practical- Continuous internal assessment

Components	Marks
Attendance and Lab involvement	2
Record	2
Viva/Model Exam	1
Total	5

iv. Class Tests: Every student shall undergo **two class tests** as an internal component for every course.

2.9.2 End Semester Examination (ESE): The End Semester Examination in theory courses shall be conducted by the college with question papers set by external experts/ question bank. The evaluation of the answer scripts shall be done by the examiners based on a well-defined scheme of evaluation given by the question paper setters/Prepared as per the direction of the Chairman, Board of Examiners. The evaluation of the End Semester Examinations shall be done immediately after the examination preferably through the centralised valuation.

2.9.3 Project

Project work is a part of the syllabus of most of the programmes offered by the college. The guidelines for doing projects are as follows:

i. Project work shall be completed by working outside the regular teaching hours.
ii. Project work shall be carried out under the supervision of a teacher in the concerned department or an external supervisor.
iii. A candidate may, however, in certain cases be permitted to work on the project in an industrial / Research Organization/ Institute on the recommendation of the Supervisor.
iv. There should be an internal assessment and external assessment for the project work in the ratio 1:3
v. The external evaluation of the project work consists of valuation of the dissertation (project report) followed by presentation of the work and viva voce.
vi. The mark and credit with grade awarded for the program project should be entered in the grade card issued by the college.

Components of Internal Evaluation for Projects

Components	**Marks**
Topic/Area selected	2
Experimentation/Data collection	5
Punctuality-Regularity	3
Compilation	5
Content	5
Presentation	5
Total	**25**

2.9.4 Project Evaluation: (Max. marks100)

Components of Project-Evaluation	Marks
Dissertation (External)	**50**
Internal Evaluation	**25**

Viva-Voce (External)	**25**
Total	**100**

2.10. Grade and Grade Points

For all courses (theory & practical), Letter grades and grade point are given on a 10-point scale based on the total percentage of marks, (CIA+ESE) as given below:-

Percentage of Marks	Grade	Grade Point (GP)
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 Average	5
35 to below 45	D Pass	4
Below 35	F Fail	0
	Ab Absent	0

Grades for the different semesters and overall programme are given based on the corresponding SGPA/CGPA as shown below:

SGPA/CGPA	Grade
Equal to 9.5 and above	***S Outstanding***
Equal to 8.5 and below 9.5	***A+ Excellent***
Equal to 7.5 and below 8.5	***A Very Good***
Equal to 6.5 and below 7.5	***B+ Good***
Equal to 5.5 and below 6.5	***B Above Average***
Equal to 4.5 and below 5.5	***C Average***

Equal to 4.0 and below 4.5	***D Pass***
Below 4.0	***F Failure***

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. A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the end semester examination for the same semester, subsequently. A student who fails to secure a minimum marks/grade for a pass in a course can be permitted to write the examination along with the next batch.

After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below. For the successful completion of semester, a student should pass all courses and score at least the minimum CGPA grade **'D'**. However, a student is permitted to move to the next semester irrespective of her/his SGPA.

Credit Point (CP) of a course is calculated using the formula

CP = Cr x GP, where Cr = Credit; GP = Grade point

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

SGPA = TCP/TCr, where

TCP = Total Credit Point of that semester $= \sum_1^n \mathrm{CPi}$**;**

TCr = Total Credit of that semester $= \sum_1^n \mathrm{Cri}$

Where n is the number of courses in that semester

Cumulative Grade Point Average (CGPA) of a Programme is calculated using the formula

CGPA $= \sum(\mathrm{SGPA} \times \mathrm{TCr}) \Big/ \sum \mathrm{TCr}$

SGPA/CGPA shall be rounded off to two decimal places

To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be published on the notice board/website at least one week before the commencement of external examination. There shall not be any chance for improvement for internal mark.

The course teacher and the faculty advisor shall maintain the academic record of each student registered for the course which shall be forwarded to the controller of examinations

through the Head of the Department and a copy should be kept in the department for at least two years for verification.

2.11. Registration for the examination

a. All students admitted in a programme with remittance of prescribed fee are eligible for the forthcoming semester examinations.

b. Online application for registration to the various End Semester Examinations shall be forwarded to the CE along with prescribed fee for each course in prescribed format.

c. The eligible candidates who secure the prescribed minimum attendance of the total duration of the course and possess other minimum qualification prescribed in the regulations for each course shall be issued the hall tickets. The hall ticket shall be downloaded by the students from the college website.

d. The mode of fee remittance shall be through the prescribed bank.

2.12. Supplementary Examinations

Candidates who failed in an examination can write the supplementary examination conducted by the College along with regular examinations.

2.13. Improvement of Examination

A candidate can improve his/her marks once by appearing again for the examination with the subsequent batch with the remittance of prescribed fee. In such cases the better of the two marks shall be taken as the marks awarded to him.

Internal assessment marks shall be carried over to the subsequent semester examination.

There shall not be any provision for improving internal assessment marks.

2.14. Promotion to the Next Higher Semester

A candidate shall be eligible for promotion from one semester to the next higher semester if,

a. He / she secures a minimum 75 % attendance and registered for the End Semester Examination of the programme for which he/she is studying.

b. His / her progress of study and conduct are satisfactory during the semester completed, as per the assessments recorded by the course teachers and the Head of the Department concerned.

2.15 Certificates

1. Degree certificates are issued by the Mahatma Gandhi University, Kottayam as per the act and statues of the University on the submission of the consolidated mark / score cards of the students by the College.
2. A consolidated mark / scored card shall be issued to the candidates after the publication of the results of the final semester examination taken by the candidate.
3. A Course Completion Certificate with classification shall be issued to students till the provisional certificate is issued by the university.

2.16. Award of Degree

The successful completion of all the courses with 'D' grade shall be the minimum requirement for the award of the degree.

2.17. Monitoring

There shall be a Monitoring Committee constituted by the principal consisting of faculty advisors, HoD, a member from teaching learning evaluation committee (TLE) and the Deans to monitor the internal evaluations conducted by college. The Course teacher, Class teacher and the Deans should keep all the records of the internal evaluation, for at least a period of two years, for verification.

Every Programme conducted under Choice Based Credit System shall be monitored by the College Council under the guidance of IQAC Coordinator, Controller of Exams, academic deans and HoDs.

2.18. Grievance Redressal Mechanism

In order to address the grievance of students regarding Continuous internal assessment (CIA) 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: At the level of the concerned course teacher

Level 2: At the level of a department committee consisting of the Head of the Department, a coordinator of internal assessment for each programme nominated by the HoD and the course teacher concerned.

Level 3: A committee with the Principal as Chairman, Dean of the Faculty concerned, HOD of the department concerned and one member of the Academic council nominated by the principal every year as members.

2.19 Pattern of questions for ESE for theory papers with practical

Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
8	8	1	**8**
8	6	2	**12**
6	4	5	**20**
4	2	10	**20**
26	**20**		**60**

Pattern of questions for ESE for papers without practical (Open Course and Elective Course)

Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
10	10	1	**10**
10	8	2	**16**
7	5	5	**25**
4	2	12	**24**
31	**25**		**75**

3. SYLLABI OF CORE COURSES

CORE COURSE I ANIMAL DIVERSITY - NON -CHORDATA I

Course Code	23U1CRZOO01
Title of the course	Animal Diversity - Non Chordata I
Semester in which the course is to be taught	1
No. of credits	2
No. of contact hours	36

Objectives

1. To make aware of the basic philosophy of science, its history, concepts and scope
2. To develop proper scientific mind, culture and work habits
3. To study the scientific classification invertebrate fauna

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Examine the history, and the scope of Zoology as Science	PSO1	U	C	2
CO2	Discuss the concept of Symmetry and Coelom	PSO1	U	C	1
CO3	Examine the principles, nomenclature, classification, Approaches and modern trends in taxonomy.	PSO1	U	C	7
CO4	Examine the concept of Two kingdom and Five kingdom classification in taxonomy	PSO1	U	C	14
CO5	Differentiate the animals in to phyla based on their characters.	PSO1	A	C	4
CO6	Analyze the life cycle and reproduction of Kingdom Protista and Animalia.	PSO1	A	C	8

Pre-requisite:

- Basic knowledge on various sciences and definitions of scientific terms
- An awareness on basic classification of animals

Module I.

Introduction To Zoology (3hr)

History of Zoology (Brief)**,** Zoology and its scopes. Zoology as science, Scientific temper, Characteristics of science. How to Make a Scientific Investigation, Pseudoscience, Laws of science.

Core Readings

Bowler Peter J. and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey.* College of Chicago Press, Chicago, IL:

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance.* Published by Harvard College Press.

Ervin Schrodinger 1944. What is life? Mind and Matter. Cambridge College Press.

Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology.* Vintage Pub. NY

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions* 3rd ed.: College of Chicago Press, Chicago, IL

Taylor, Green, Stout (2008) Biological Science, Cambridge College, Press, p 951.

Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Pubslishers, Kottayam.

Module II.

Symmetry and Coelom (1 hr)

Symmetry - Asymmetry, Spherical, Radial, Biradial and Bilateral
Coelom – Acoelomates, Pseudocoelomates and Eucoelomates
Schizocoelom, Enterocoelom., Protostomia and Deuterostomia

Core Readings

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

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

Module III.

Taxonomy (6 hrs)

Taxonomy-Definition, Principles of taxonomy, Modern trends in taxonomy. (Molecular taxonomy) Approaches of taxonomy. Phylogeny and taxonomy, **Components of classification**, Taxonomical hierarchy – taxon, category and rank, Linnaean hierarchy, nomenclature, Principles of nomenclature., International Code of Zoological Nomenclature (ICZN), Rules of nomenclature, Law of priority, Homonymy and Synonymy. (Brief)uni, bi and trinomials. Mention taxonomic aids.

Core readings

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

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

Module IV

Kingdom Protista (13 hrs)

Type: Paramecium

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

Salient features and classification up to phyla

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

Phylum Rhizopoda: Eg. Amoeba; Phylum Actinopoda: Eg. Actinophrys; Phylum Parabasalia: Eg. Trychonympha; Phylum Metamonada: Eg. Giardia; Phylum Kinetoplasta: Eg. Trypanosoma; Phylum Ciliophora: Eg. Paramecium; Phylum Opalinata: Eg. Opalina; Phylum Sporozoa: Eg. Plasmodium; Phylum Choanoflagellata: Eg. Proterospongia

Plant-like protists (Mention any five general characters for each phylum. Detailed accounts of examples are not necessary)

Phylum Euglenophyta: Eg. Euglena; Phylum Cryptophyta: Eg. Cryptomonas; Phylum Bacillariophyta: Eg. Diatoms; Phylum Chlorophyta: Eg. Volvox; Phylum Dinoflagellata: Eg. Noctiluca

Fungus-like protists (Mention any five general characters for each phylum. Detailed accounts of examples are not necessary)

Phylum Microsporidia: Eg. Nosema

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

General Topics :(1)Parasitic Protozoans (2). Life cycle of Plasmodium

Module V

Kingdom Animalia (1hr)

Outline classification of Kingdom Animalia.

Three branches - Mesozoa, parazoa, Eumetazoa.

Core Readings

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. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

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

Module VI

Mesozoa - Eg. Rhopalura (3 hrs)

Phylum Porifera.

Classification upto classes.

Class I- Calcarea. Eg. Sycon.,Class II – Hexactinellida . Eg. Euplectella.

Class III – Demospongia Eg. Cliona.

General Topics

1. Reproduction in sponges 2. Canal system in sponges.

Module VII

Phylum Coelenterata (7 hrs)

Type: Obelia

Classification upto classes.

Class I - Hydrozoa: Eg. Halistemma. Class II – Scyphozoa : Eg. Rhizostoma. Class III- Anthozoa Eg. Fungia.

General Topics: Coral and coral reefs with special reference to conservation of reef fauna.

2. Polymorphism in Coelenterates

Core Readings

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

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

Module VIII

Phylum Ctenophora.(1 hr)

Eg. Pleurobrachia.

Core Readings

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

23U2PRZOO01: PRACTICAL 1
ANIMAL DIVERSITY – NON CHORDATA I
(36 hours)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Examine the structure and function of simple and compound light microscopes & Camera Lucida	PSO1	A	P	8
CO2	Analyze the specimens by their generic names	PSO1	A	C	4
CO3	Apply the principles in Scientific Drawing	PSO1	A	P	10
CO4	Examine the anatomy of Hydra	PSO1	An	F	2
CO5	Differentiate the larval forms	PSO1	An	C	4
CO6	Analyze the specimens of insects	PSO1	An	C	8

1. Study of simple and compound light microscopes
2. Camera Lucida (Demonstration)
3. Simple identification. (Minimum10 specimens. All specimens by their generic names and 50% of these by their species name.)
4. Scientific drawing. (Minimum 5 specimens)
5. Anatomy – Study of section (Hydra)
6. Study of larval forms. (Minimum four)
7. Insect identification using key. (Up to Order)

CORE COURSE 2 : ANIMAL DIVERSITY – NON CHORDATA II

Course Code	23U2CRZOO02
Title of the course	Animal Diversity - Non Chordata II
Semester in which the course is to be taught	2
No. of credits	2
No. of contact hours	36

Objectives:

1. To create appreciation on diversity of life on earth
2. To study the scientific classification of invertebrate fauna.
3. To learn the physiological and anatomical peculiarities of some invertebrate phyla through type study.
4. learn the evolutionary significance of various invertebrate fauna
5. To stimulate the curiosity in living things around them.

Pre requisite:

- Basic knowledge on the living world, plant and animal kingdom
- Knowledge on biodiversity and its conservation
- Knowledge on biological classification and representative organism of major taxa

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Classify phylum Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca and Hemichordata	PSO1	U	C	18
CO2	Examine the Life history of platyhelminth parasites	PSO1	U	C	4
CO3	Discuss pathogenic nematodes	PSO1	U	C	4
CO4	Examine the vectoral arthropods	PSO1	U	C	4
CO5	Differentiate the larval forms of Penaeus	PSO1	An	C	2
CO6	Discuss pearl formation and culture	PSO1	U	C	2
CO7	Examine the water vascular system in Echinodermata	PSO1	U	C	2

Module I

Phylum Platyhelminthes (3hrs)

Classification upto classes.

Class I - Turbellaria. Eg. Planaria.

Class II – Trematoda Eg. Fasciola

Class III- Cestoda Eg. *Taenia saginata.*

General Topics-

1. Life history of *Fasciola hepatica.*

2. Platyhelminth parasites of Man and Dog (Schistosoma, *Taenia solium,* Echinococcus).

Module II

Phylum Nematoda (2 hrs)

Class Phasmidia Eg. Enterobius, Ascaris

Class Aphasmidia Eg. Trichinella

General Topic-

Pathogenic nematodes. (Wuchereria bancrofti, Ancylostoma duodenale, Trichinella).

Module III

Phylum Annelida (7 hrs)

Classification upto classes.

Class I- Archiannelida Eg. Polygordius

Class II – Polychaeta Eg. Chaetopterus

ClassIII- Oligochaeta Eg. Megascolex.

Class IV - Hirudinea Eg. Ozobranchus

Type - Earthworm

Core Readings

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

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

Module IV

Phylum Arthropoda (12 hrs)

Type: Penaeus

Classification upto classes.

Divided into 4 subphyla.

1. Sub Phylum - Trilobitomorpha

Class - Trilobita (mention salient features).

2. Sub Phylum- Onychophora

Class – Onychophora . Eg. Peripatus (Mention its affinities).

3. Sub Phylum- Mandibulata

Class I – Crustacea Eg. Sacculina
Class II- Chilopoda Eg. Centipede
Class III – Diplopoda Eg. Millipede
Class IV - Insecta Eg. Dragon fly

4. Sub Phylum - Chelicerata

Class I- Merostomata Eg. Limulus
Class II – Arachnida Eg. Scorpion

General Topics

1. Vectorial Arthropods
2. Larval forms of Penaeus

Core Readings

Zoological Society of Kerala Study material. *Animal Diversity* 2002.
Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

Module V

Phylum Mollusca (5 hrs)

Classification upto classes
Class I- Monoplacophora Eg. Neopilina
Class II- Amphineura Eg. Chiton
Class III- Gastropoda Eg. Aplysia
Class IV- Scaphopoda Eg. Dentalium
Class V- Pelecypoda Eg. Pinctada
Ciass VI- Cephalopoda Eg. Sepia

General Topic-

Pearl formation and culture

Module VI

Phylum Echinodermata (4 hrs)

Classification upto classes
Class I- Asteroidea Eg. Astropecten
Class II- Ophiuroidea Eg. Ophiothrix
Class III- Echinoidea Eg. Echinus
Class IV- Holothuroidea Eg. Holothuria
Class V – Crinoidea Eg. Antedon
Brief account on larval forms.

General Topics

1. Water vascular system.

Module VII

Minor Phyla (**2 hrs)**

1.General account and examples

Module VIII

Phylum Hemichordata (1 hr)

Eg. Balanoglossus (Affinities)

Core Readings

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

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

Selected Further Readings

Anderson D.T. 2001Invertebrate Zoology Sec Edition Oxford College Press

Barnes R.D. 1987. Invertebrate Zoology. W. B. Saunders. New York.

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

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

Hyman L. H. The Invertebrate Volumes. Mc Graw Hill.

Jordan. E. L., and Verma P.S. 2000. Invertebrate zoology. S. Chand and Co. ltd., New Delhi.

Kotpal R. L, Agarval S. K. and R. P. Khetharpal 2002. Modern Textbook of Zoology.

23U2PRZOO01: PRACTICAL 1
ANIMAL DIVERSITY - NON CHORDATA - II
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyse invertebrate morphology and anatomy	PO1 PSO4	A	P	4
CO2	Analyse Prawn Nervous system and appendages	PO1,PO4 PSO4	A	P	8
CO3	Analyse Cockroach Nervous system and mouthparts	PO1 PSO4	An	P	8
CO4	Analyse insect mouth parts and annelid setae	PO1 PSO4	An	P	4
CO5	Application of taxonomic principles in identification of invertebrates.	PO1 PSO4	An	P	12

1. **Anatomy:-**
   Study of sections. (Any two)
   A. Ascaris
   B. Earthworm
   C. Fasciola
2. **Dissections**
   A. Prawn - Nervous system
   B. Cockroach - Nervous system
3. **Mounting:-**
   A. Cockroach - Salivary glands
   B. Mouth parts - Plant bug/House fly/Mosquito/Cockroach/Honey bee (Any Two)
   C. Prawn appendages.
   D. Earthworm setae
4. **General identification**
   A. Minimum twenty specimens. (Taxonomic classification and Ecological/Morphological/Evolutionary/Economic importance)
5. **Virtual Dissection**
   Virtual dissection of cockroach using Virtual Roach

CORE COURSE 3 : ANIMAL DIVERSITY – CHORDATA

Course Code	23U3CRZOO03
Title of the course	Animal Diversity - Chordata
Semester in which the course is to be taught	3
No. of credits	3
No. of contact hours	54

Objectives

1. To make the student observe the diversity in chordates and their systematic position.
2. To make them aware of the economic importance of some classes.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Illustrate classification of Phylum Chordata with examples	PO1 PSO1	U	C	8
CO2	Become aware of the characteristics, adaptations, migration and parental care in Pisces	PO1 and PO4 PSO1	U	C	10
CO3	Illustrate the classification of amphibians, their characteristics and adaptations	PO1 PSO1	U	C	10
CO4	Elucidate the classification of amniotes and their adaptations with examples	PO1 and PO4 PSO1	U	C	8
CO5	Elaborate on the classification and characteristics of class mammalia	PO1 and PO4 PSO1	U	C	18

Module I

Phylum Chordata (8 hrs)

General characteristics and classification

Sub phylum: Urochordata

Class I: Larvacea: Eg. Oikopleura

Class II : Ascidiacea :Eg: Ascidia (Mention Retrogressive Metamorphosis)

Class III :Thaliacea: Eg: Doliolum

Sub phylum: Cephalochordata: Eg. Amphioxus

Sub phylum: Vertebrata

Division 1– Agnatha

Class I Ostracodermi : Eg: Cephalaspis

Class II Cyclostomata : Eg: Petromyzon

Division 2 – Gnathostomata

Module II

Super class Pisces (10 Hrs)

Class: Chondrichthyes

Sub class – Elasmobranchi Eg: Narcine

Sub class Holocephali Eg: Chimaera

Class: Osteichthyes

Sub class – Choanichthyes

Order 1 Crossopterigii : Eg: Latimeria

Order 2 Dipnoi : Eg: Lepidosiren

Sub class: - Actinopterygii

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. Scales in fishes.
4. Migration in fishes
5. Lung fishes

Module III

Class Amphibia (10 Hrs)

Type study: Frog (Brief account of all systems)

Order I Anura : Eg: Bufo

Order II Urodela : Eg: Ambystoma (Mention axolotl larva and neotony)

Order III Apoda : Eg: Ichthyophis.

Parental care in Amphibia (Brief account only)

Module IV

Class Reptilia (**4 Hrs)**

Sub class I: Anapsida

Order Chelonia :Eg: Chelone

Sub class II: Parapsida : Eg: Ichthyosaurus

Sub class III: Diapsida

Order 1 Rhynchocephalia : Eg: Sphenodon

Order 2 Squamata : Eg: Chamaeleon

Order 3 Crocodilia : Eg. Crocodilus

Sub class IV: Synapsida : Eg: Cynognathus

General topic

Identification of poisonous and non -poisonous snakes

Module V

Class Aves (4 Hrs)

Sub class I: Archeornithes : Eg: Archaeopteryx (Affinities)

Sub class II: Neornithes

Super order I: Palaeognathe Eg: Struthio

Super order II: Neognathe Eg: Brahminy kite

General topics

1. Migrations in birds
2. Flight adaptations in birds

Module VI

Class Mammalia (18Hrs)

Type study: Rabbit (Brief account of all systems)

Sub class I: Prototheria Eg: Echidna

Sub class II: Metatheria Eg: Macropus

Sub class III: Eutheria

Order 1. Insectivora Eg: Talpa

Order 2 Dermoptera Eg: Galeopithecus

Order 3. Chiroptera Eg: Pteropus

Order 4. Primates Eg: Loris

Order 5 Carnivora Eg: Panthera

Order 6 Edentata Eg: Armadillo

Order 7 Pholibota Eg: Manis

Order 8 Proboscidea Eg: Elephas

Order 9 Hydracoidea Eg: Procavia

Order 10 Sirenia Eg: Dugong

Order 11 Perissodactyla Eg: Zebra

Order 12 Artiodactyla Eg: Cameleus

Order 13 Lagomorpha Eg: Oryctolagus

Order 14 Rodentia Eg: Porcupine

Order 15 Tubulidentata Eg: Orycteropus

Order 16 Cetacea Eg: Delphinus

General topics

1. Dentition in Mammals
2. Aquatic Mammals

Core Readings

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

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

Thomas A P (Editor) 2010 Chordata .Green leaf publications Kottayam

Zoological Society of Kerala Study material. *Animal Diversity* 2002&2011

Selected Further 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.

Young J.Z. 2006 The life of Vertebrates Oxford University Press (Third Ed.) India Ed.

23U4PRZOO02: PRACTICAL 2
ANIMAL DIVERSITY – CHORDATA
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Apply taxonomic principles and identify animals by their scientific names	PO1 and PO4 PSO4	A	P	6
CO2	Analyse and study different organ systems of the frog	PO1 and PO4 PSO4	A	P	6
CO3	Examine the structure of scales, girdles, vertebrae and skull	PO1 PSO4	A	P	2
CO4	Analyze various fishes and snake specimens and assign them to different taxa	PO1 and PO4 PSO4	A	P	6

1. **Morphology: Scientific Drawing**
   Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes

2. **Dissections**
   Frog: Photographs/diagrams/Virtual lab/models may be used for study.
   1. Frog Viscera
   2. Frog Digestive System
   3. Frog Sciatic Plexus
   4. Frog Brain
   5. Frog Arterial system

3. **Mounting** of placoid scales/cycloid/ctenoid scales

4. **Osteology**
   Frog vertebrae
   Pectoral and pelvic girdles of Frog and Rabbit
   Turtle – plastron and carapace
   Rabbit skull

5. Study of sections.
   Amphioxus T. S. through pharynx/ intestine

6. Identification:-

General identification-

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

Protochordata-1, Pisces-4, Amphibia-3, Reptilia- 4, Aves-1, Mammalia-2.

7. Taxonomic identification with key:-

i) Identification of fishes up to the level of order.

ii) Identification of snakes up to family.

8. Virtual Dissection:

Virtual dissection of Frog:

https://dcc.ilc.org/snc2d/14/the_frog_a_virtual_dissec/the_frog_a_virtual_dissec.html

CORE COURSE 4: APPLIED ZOOLOGY

Course Code	23U4CRZOO04
Title of the course	Applied Zoology
Semester in which the course is to be taught	4
No. of credits	3
No. of contact hours	54

OBJECTIVES

Equip the students interested in the applied branches of zoology with skills and knowledge which can lead to self-employment opportunities.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Discuss the traditional methods of aquaculture and recognizing the commonly cultivated species of Kerala	PSO2	U	C	10
CO2	Explain fish, prawn, mussel and pearl culture techniques, fish diseases, fish preservation and processing.	PSO2	U	C	8
CO3	Discuss the life history of silkworms, species of silkworms, method of sericulture, diseases and pests and management practices for developing entrepreneurial skills.	PSO2	U	C	8
CO4	Explain the significance and practice of vermiculture and various species of earthworms	PSO2	U	C	5
CO5	Recognize different species of Honey bee, apiary, bee keeping methods, bee pasturage, diseases and pests	PSO2	U	C	10
CO6	Explain the significance of Poultry and Animal Husbandry, different strains used and their management practices	PSO2	U	C	13

Module 1:

Aquaculture (18 hrs)

Traditional methods of aquaculture, Advantages and salient features of aquaculture, Types of aquaculture, Biotic and abiotic factors of water.

Pond culture, 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, Common species of Aquarium fishes.

Prawn culture, Mussel culture , Pearl culture

Sustainable practices for environment friendly Aquaculture

Core Readings:

Applied Zoology; (2002) Published by Zoological Society of Kerala

Module 2

Sericulture (8hrs)

Types of silk, Four species of silkworms, Life history of *Bombyx mori*, Silkworm Rearing Techniques-Mounting of worms, harvesting and extraction of silk.Silkworm diseases, Preventive and control measures.

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Module 3

Vermiculture (5 hrs)

Species of Earthworms suitable for vermiculture. Reproduction and Life Cycle. Factors affecting vermiculture, Vermicomposting, Site Selection, Preparation of pit, Maintenance and Monitoring

Core Readings

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Venkit Sivaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin).

Module 4

Apiculture (10 hrs)

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.

Core Readings

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Shukla G.S., &Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Module 5

Poultry Science (8 hrs)

Introduction, Importance of egg production, Nutritive value of eggs.

Breeds of fowl: a) Exotic breeds: Rhode Island Red, Plymouth Rock, New Hampshire. b) Indigenous breeds: Chittagong, Gangus

Poultry breeding: meat production

Quail culture (Briefly)

Core Readings:

Sastry, N.S.R. Farm Animal Management & Poultry Prodcution.

Sastry N.S.R.: Farm Animal Management & Poultry Production. Vikas.

Singh H &Mossa: Livestock & Poultry Production, PHI.

Module 6

Animal Husbandry (5 hrs)

Introduction, Live stock husbandry - origin, domestication of cattle.

Breeds of cattle.

Common diseases- Anthrax, Foot and Mouth disease, Rinderpest

Biogas production.

Core Readings:

Campbell, J.R. &Lasley, J.R: The Science of Animals that serve Mankind. TMH. Eckles, C.R. Combs, W.B. & Macy, H.: Milk & Milk Products. Tata MGH. ICARD: Handbook of Animal Husbandry, 1990/97, ICAR, Pusa, N.d.

Selected Further Readings

Alikunhi, K.h., Fish Cluture in India (ICAR, New Delhi)

Bhosh, C.C., 1949, Silk Production and Weaving in India (CSIR), New Delhi) Director. Zoological Survey of India, 1994, earthworms Resources and Vermiculture

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

Jhingran, V.G., 1985 Fish and Fisheries of India (Hindustan Publ. Corporation, New Delhi)

Kurien, C.V. & Sebastian V.C., Prawn Fisheries in India (Hindustan Publ. Corporation, New Delhi)

Krishnaswami, S., 1986 Improved Method of Rearing Young age Silk worms (Central Silk board Bangalore)

Krishnaswami, S., 1986, New Technology of Silkworm Rearing (Central Silk Board Bangalore)

Lee, K. E., 1985 Earthworms, Their Ecology and relationships with Soils and Land use. Academics Press.

Menon, K.N., 1970 Malsyakrishi (State Institute of language, Trivandrum)

Mysore Silk Association, 1986, Silkworm rearing and Diseases of Silkworms

PadmanabhaAiyer, K.S., 1992, Records of the Indian Museum Vol. XXXI, Part I, PP. 13-76 An Account of the Oligochacta of the Travancore

Shiggene, K., 1969, Problems in Prawn Culture (American publ. Co., New Delhi)

Shukla G.S., &Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Andhra Pradesh Agricultural University, Hydrabad)
Sinhan, V.R.P. & Ramachandran, V., 1985, Fresh water Fish Culture (ICAR, New Delhi)
Singh, S., 1962 Bee keeping in India (ICAR, New Delhi)
Singh, V.P.P. and Ramachandran, V., 1985 Freshwater Fish Culture (ICAR, New Delhi)
Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)
Ullal, S. R. and Narasimahanna, M.N., Handbook of Practical Sericulture (Central Silk Board Bombay.)
Venkitaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

23U4PRZOO02 : PRACTICAL 2

APPLIED ZOOLOGY

(36 Hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyse, identify and examine the culturable species of fishes	PO1, PO4 PSO4	E	P	6
CO2	Analyse, identify and examine culturable species of earthworms, castes of honey bees and silkworm	PO1, PO4 PSO4	E	P	6
CO3	Analyse the bee keeping equipments and chandrike and develop entrepreneurial skills	PO1, PO4 PSO4	E	P	6
CO4	Examine the products and by-products of apiculture, sericulture and vermicomposting	PO1 PSO4	E	P	6
CO5	Analyse and study the different types of fish diseases and fish parasites	PO1, PO4 PSO4	E	P	6
CO6	Analysis of the gut content of fish and determine its feeding habits	PO1 PSO4	E	P	6

1. General Identification, Economic importance, Morphology, scientific names and common names of the following
    a. Economic importance and morphology of cultivable fish species (Catla, Rohu, Mrigal, Etroplus, Tilapia) and shellfish species (*Penaeus indicus/P.monodon/Macrobrachium, Pernaviridis/P.indicus, Pinctada fucata*)
    b. 2 species of earthworms used in Vermiculture
    c. Two species of honey bees
    d. Silkworm. Cocoon/Adult
2. Castes of bees
3. Bee keeping equipments Beehive, Smoker, honey extractor
4. Beeswax, Honey, Silk, Vermicompost (Identification-Uses)
5. Chandrike used in sericulture
6. Poultry breeds (picture identification)
7. Cattle breeds (picture identification)
8. Fish – Gut content analysis to determine feeding habits.

CORE COURSE 5 : CELL AND MOLECULAR BIOLOGY

Course Code	23U5CRZOO05
Title of the course	Cell and Molecular Biology
Semester in which the course is to be taught	5
No. of credits	3
No. of contact hours	54

Objectives:

1. To emphasize the central role of Cell biology and Molecular biology, being the most 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.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Summarize the history and scope of cell and molecular biology, cell theory, prokaryotes, eukaryotes, Actinomycetes, Mycoplasmas, virus, virion and viroids and prions	PO1 PSO3	U	C	2
CO2	Explain plasma membrane, the various models of plasma membrane and its modifications, cell permeability and functions and also the ultrastructure of the cytoplasm and cell organelles.	PO1 PSO3	U	C	13
CO3	Describe the structure and functions of the nucleus and a basic understanding of chromosomes and its structure and explain cell cycle, cellular communication	PO1 PSO3	U	C	12
CO4	Explain the basic nature of the genetic material, DNA structure, types, replication, modern concept of gene, prokaryotic and eukaryotic genome, central dogma of molecular biology, genetic code and protein synthesis in prokaryotes	PO1 PSO3	U	C	19
CO5	Summarize gene regulatory mechanisms, operon concept both lac operon and tryptophan operon	PO1 PSO3	U	C	8

PART I - CELL BIOLOGY (27 hrs)

Module I

History of cell and molecular biology (2 hrs)

Cell theory, Prokaryotes, Eukaryotes, Actinomycetes, Mycoplasmas, Virus, Virion and Viroids, Prions,

Core Readings

Thomas AP (Editor)2011 Cell & Molecular Biology

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 1

Zoological Society of Kerala Study material. 2008. *Microbiology and Immunology* Chapter

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

Core Readings

Thomas AP(Editor) 2011 Cell &Molecular Biology The Fundamentals. Green leaf publications .TIES Kottayam.

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 4

Gupta M.L. & M.L. Gangir. (1998) Cell Biology. Agrobotanica

James Darnell. (1998) Molecular Biology. Scientific American Books Inc.

Module III

Ultrastructure of Cytoplasm (7 hrs)

Cytoskeleton - Microtubules, microfilaments, intermediate filaments.

Endoplasmic reticulum - Structure and functions

Ribosomes (Prokaryotic and Eukaryotic)

Golgi complex - Structure and functions.

Lysosomes Polymorphism - GERL concept, functions

Mitochondria - Structure and functions

Symbiont hypothesis.

Core Readings

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 4

Module IV

Nucleus (**6 hrs)**

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

Core Readings

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 4

Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)

Rastogi S. C. (1998) Cell Biology,Tata Mc.Graw Hill Publishing Co. NewDelhi

Module V

Cell Division (3 Hrs)

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

Core Readings

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 6

Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)

Rastogi S. C. (1998) Cell Biology. Tata Mc.Graw Hill Publishing Co., New Delhi

Module VI

Cell Communication (3 Hrs)

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

Core Readings

Karp. G., 1996 *Cell and Moecular Biology, Concepts and Experiments*, John Wiley and Sons New York.

PART II - MOLECULAR BIOLOGY (27 Hrs)

Module VII

Nature of Genetic Materials (7 Hrs)

Discovery of DNA as genetic material – Griffith's transformation experiments. Contributions of Avery, Macleod and McCarthy, Hershey Chase Experiment of Bacteriophage infection. Meisselson and Stahl experiment. Watson-Crick model of DNA, Clover leaf model of t-RNA, Different types of DNA and RNA, Semi-conservative method of DNA replication

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

Core Readings

Thomas AP (Editors) 2011 Cell & Molecular Biology The Fundamentals. Green leaf publications TIES Kottayam

Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ane's Books, India Chapter -5 pp. 124-138.

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 9

Module VIII

Gene Expressions (12 hrs)

Central Dogma of molecular biology, Reverse transcription, One gene-one enzyme hypothesis, One gene-one polypeptide hypothesis. Characteristics of genetic code, Contributions of Hargobind Khorana. Protein synthesis in Prokaryotes – Transcription and Translation

Gene regulation in Eukaryotes – Chromatin modification, Transcriptional, Post-transcriptional, Translational and Post-translational modifications.

Core Readings

Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ane's Books, India Chapter -12 pp. 282-292, Chapter 13, pp293-318.

Sobti R.C. & G. Obe. (2000) Eukaryotic Chromosomes. Narosa Publishing House.

Taylor D.J. Green N.P.O and stout Biological Science 2009 3rd edition Chapter 23 pp.802-807.

Module IX

Gene regulations (8 hrs)

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

Core Readings

Madigan, Martinko and Parker 2002. *Biology of Microorganisms 8th edition Prentice Hall, Chapter 7 pages 226-245.*

Veer Bala Rastogi. (2008). *Fundamentals of Molecular Biology*, Ane's Books, India Chapter 15, pp343--378.

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 9

Selected Further Readings

Ariel G Loewy Philip Sickevitz, John R. Menninger and Jonathan A.N. Gallants (1991) Cell structure and function. Saunder's College Publication

Arthur & Tania. (1991) DNA Replication. W.H. Freeman & Co. New York.

Arthur M Lesk. (1990) Introduction to Genomics. Oxford University Press

Carraway K.L. & C.A.C. Carraway. (2002) Cytoskeleton signalling, Oxford University Press

Charlotte J Avers. (1986) Molecular Cell Biology. The Benjamin / Cummings Publishing Company Inc.

Cohn N.S. 1979 Elements of Cytology (Freeman Book Company).

Daniel & Elizabeth. (1996) Genetics-Principle and Analysis. Jones & Bartlett Publishers
David A Micklos & Greg A Freyer. (2006) DNA Science. Cold Spring Harbor Laboratory Press
David Latchman. (2006) Gene Regulation. London Unwin Hyman
David M. J. Lilley. (2003) DNA-Protein Structural Interactions. Frontiers in Molecular Biology.
De- Robertis E.D. and De Robertis Jr.E.M.F (2002) Cell and Molecular Biology (Lea & Febiger/Info-Med)
Earl R Stadtman & P. Boon Chock. (2000) Current Topics in Cellular Regulation. Academic Press
Edwards & Hassall. Mc.Graw Hill Publishing Co.Ltd., U.K.
Finean & Michell. (1998) Membrane Structure. Holland Bio-Medical Press, Netherland.
Gardner E.J. and Snustand D.P. Principles of Genetics. John Wiley & Sons, New York.
Gupta M.L. & M.L. Gangir. (1998) Cell Biology. Agrobotanica
James Darnell. (1998) Molecular Biology. Scientific American Books Inc.
Karp G. (1996) Cell and Molecular Biology: Concepts and Experiments John Wiley and Sons m, New York
Kimball J.W. 1984 Cell Biology (Addison - Wesley Pub. Co.)
Kwang W Jeon. (1997) A Survey of Cell Biology. Academic Press
Malcolm N. Jones & Dennis Chapman. (1991) Micelles, Monolayers and Biomembranes. John Willey & Sons Inc. Publication
Michael T.A. Michael, E.R. and Toya S.K. (1975) Electron Microscopy and Cell Structure. Cambridge University Press
Mitchison J.M. (1991) The Biology of the Cell Cycle, Cambridge University Press
Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)
Rastogi S. C. (1998) Cell Biology. Tata Mc.Graw Hill Publishing Co., New Delhi
Sinnot Dunn & Dobzhanasky. (1991) Principles of Genetics. T.M.H. New Delhi.
Sobti R.C. & G. Obe. (2000) Eukaryotic Chromosomes. Narosa Publishing House.
Stanley G. Schultz. (2002) Basic Principles of Membrane Transport. Cambridge University Press
Stephen L Wolfe. (1981) Biology of the Cell. Wadsworth Publishing Co. Inc.
Swanson Metz and Young (1983) Cytology and Cytogenetics (Macmillan and Co. Ltd.)
Samuel J M,Lilly Chacko,Abraham Samuel and Punnen Kurian 2011 Cell and Molecular Biology The Fundamentals -Green leaf publications TIES Kottayam
Varma P.S. and Agarwal V.K. (1988) Cytology (S.Chand & Co., New Delhi)
Varma P.S. and Agerwal V.K. (2008) Genetics (S.Chand & Co., New Delhi)
Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ani Books, India
West I.C. (2002) Biochemistry of membrane transport. Chapman & Hall, London
William & Daphne. (2008) Biochemistry & Molecular Biology. Oxford University Press

23U6PRZOO04:PRACTICAL 4
CELL AND MOLECULAR BIOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Examine and evaluate the mitotic stages of onion root tip	PO1 PSO4	A and E	P	4
CO2	Apply scientific principles and analyse the polytene chromosome of Chironomous larva Analyse the slides of various tissues and distinguish them on the basis of various cellular features	PO1 PSO4	A	P	6
CO3	Examine, draw and identify the meiotic stages Identify and analyse cell organelles Analyze the structure of DNA, RNA and DNA replication models	PO1 PSO4	A	P	6
CO4	Apply the staining techniques to prepare temporary and permanent whole mounts of speciments	PO1 PSO4	A	P	2
CO5	Analyze the human blood cell configuration and structurally differentiate the leucocytes	PO1 PSO4	A	P	2

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

CORE COURSE 6 : ENVIRONMENTAL BIOLOGY

Course Code	23U5CRZOO06
Title of the course	Environmental Biology
Semester in which the course is to be taught	5
No. of credits	3
No. of contact hours	54

Objectives

- To impart basic knowledge on ecosystems and their functioning
- To instill the basic concepts of Environmental Sciences, Ecosystems, Natural Resources, Population, Environment and Society
- To make the students aware of natural resources, their protection, conservation, the factors polluting the environment, their impacts and control measures.
- To create a consciousness regarding Biodiversity, environmental issues & conservation strategies
- To create awareness about disasters, prevention and mitigation measures

Pre-requisite:

- Basic knowledge on ecosystem, food chain, food web and energy flow
- General awareness on pollution and their impacts

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Discuss the history, development, branches and scopes of Environmental Biology	PSO3	U	C	2
CO2	Outline the basics of ecosystems and explain their classification, structure and functions	PSO1 & PSO3	U	F	1
CO3	Evaluate the importance of wetlands and explain their conservation efforts by the UN.	PSO1 & PSO3	U	C	17
CO4	Evaluate the importance of natural resources for the survival of humankind and explain the significance of sustainable development	PSO3	U	C	2

	concept in ensuring human rights.				
CO5	Elaborate on the changes in the environment due to pollution, and explain the consequences of pollution as well as explaining mitigation efforts by UN	PSO3	U, E	C	8
CO6	Outline the natural and anthropogenic disasters, concept of hazard preparedness and mitigation of disaster consequences	PSO3	U	C	11

Module I

Introduction to Environmental Biology (2 hrs)

History, Development, Scope and branches

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.

Nambiar, K.R. 2008.*Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971.Fundamentals of Ecology.W.B. Saunders College Publishing, Philadelphia.

Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Module II

Ecosystems (18 hrs)

Concept, classification

Terrestrial ecosystem - Abiotic/ biotic components (Brief description only), Interactions

Classification (Types) – Forest, Desert, Grassland

Causes of land degradation with special reference to Kerala

Freshwater ecosystem - Physico chemical nature (Brief description only)

Types: Lentic and Lotic – Adaptations of animals living in these habitats, Ground water

Threat to freshwater resources of Kerala , Watershed management

Marine ecosystem - Physico chemical nature (Brief description only),

Intertidal zone, Rocky shore, Muddy shore, Sandy shore, Coral reefs, Wetland and mangroves, Estuaries

Convention on wetlands (Ramsar, 1971), Ramsar sites in Kerala –threats and conservation aspects

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.

Nambiar, K.R. 2008.*Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971.Fundamentals of Ecology.W.B. Saunders College Publishing, Philadelphia.

Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Zoological Society of Kerala Study material. 2002. *Environmental Biology and Ethology* Published by Zoological Society of Kerala.

Module III

Concepts of Population and Community (5 hrs)

(Brief account only)

Concept of Population - Population attributes, Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves

Animal interactions – Positive (Commensalism, Mutualism, Proto-cooperation) and Negative (Predation, Parasitism, Competition, Antibiosis)

Characteristics of a community - Species diversity- richness, evenness

Ecological indicators - Ecotone and Edge effect

Keystone species

Concepts of Ecological Niche and Guild

Ecological succession, Community evolution and the concept of climax community.

Core Readings

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

Zoological Society of Kerala Study material. 2002. *Environmental Biology and Ethology* Published by Zoological Society of Kerala.

Module IV

Biodiversity (5 hrs)

Introduction to Biodiversity - Types of biodiversity- Alpha, Beta and Gamma diversity.

Concept and importance of Biodiversity - Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots

Protected area concept – Sanctuary, National Park, Biosphere reserve, Conservation reserves Concept of threatened fauna – IUCN categories, Extinct, Extinct in the wild, Critically endangered, Endangered, Vulnerable, Near threatened, Least concern and data deficient, Red Data Book, Green Data Book

Core Readings

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

Zoological Society of Kerala Study material. 2002. *Environmental Biology and Ethology* Published by Zoological Society of Kerala.

Module V

Man and Environment (6 hrs)

Natural resources -Introduction

Energy resources - Conventional Energy resources, Non-conventional Energy resources, Exhaustible and Inexhaustible energy resources, Energy conservation measures

Human Rights and their violation in the overexploitation of natural resources.

Concept of Sustainable Development and ethical treatment of natural resources; Sustainable Development Goals (SDGs)

Core Readings

Andrew S. Pullin 2002 *Conservation Biology*. Cambridge University Press, Cambridge, UK

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

Kaufman G.Donald and Cecilia M. Franz. 2000. *Biosphere 2000 Protecting Our Global Environment.* Kendall/Hunt Publishing Company. Iowa, US

Module VI

Environmental Pollution (4 hrs)

(Brief account only)

Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution Nuclear pollution

Core Readings

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

Nambiar, K.R. 2008.*Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Meera Asthana and Astana D.K.1990 Environmental pollution and Toxicology Alka printers.

Lutgens, F.K. and Tarbuek, J.E.1992.The Atmosphere. Prentice Hall, New Jersey.

Module VII

Global environmental changes (7 hrs)

Global warming - Green house effect, Ozone depletion

Climate change (Brief description only) - Definition- recent developments, Kyoto protocol, IPCC/UNFCC

Carbon credit, Carbon sequestration, Carbon trading

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.

Nambiar, K.R. 2008.*Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Module VIII

Municipal Solid Waste (3 hrs)

Plastic pollution - Types of plastics, Problems of plastics, Management strategies

Biowastes and their management. –aerobic and anaerobic systems.

e-waste - Major types and sources, Toxic ingredients

Effects on environment and human health (Brief description only)

Management strategies

Core Readings

Nambiar, K.R. 2008.*Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971.Fundamentals of Ecology.W.B. Saunders College Publishing, Philadelphia.

Module IX

Disaster Management (4 hrs)

Definition and Classification – Natural, Anthropogenic, Hybrid

Earthquake, Landslide, Flood, Drought, Cyclone, Tsunami

Mitigation measures for disaster management

Core Readings

Singh, S.R., 2008 *Disaster Management.* A.P.H Publishers

Selected Further Readings

Ahuwalie V.K., Sunita Malhotra, 2009 Environmental science, Ane Books Pvt. Ltd.

Alan Beeby, 2006 Anne – Maria Brennan First Ecology, Ecological principles and Environmental issues . International students edition Sec. edition Oxford University Press.

Andrew S. Pullin 2002 *Conservation Biology*. Cambridge University Press, Cambridge, UK

Banerjee, L.K., Sastry, A.R.K. and Nayar, M.P. 1989. Mangroves in India: Identification manual. Botanical Survey of India.

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

Erach Bharucha 2008 (UGC).Test Book of Environmental Studies of Undergraduate course. University Press

Kaufman G.Donald and Cecilia M. Franz. 2000. *Biosphere 2000 Protecting Our Global Environment.* Kendall/Hunt Publishing Company. Iowa, US

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

Misra S.P., Pandy S.N. 2009Essential Environmental Students , Ane books Pvt. Ltd.

Nambiar, K.R. 2008.*Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971.Fundamentals of Ecology.W.B. Saunders College Publishing, Philadelphia.

Pandey Kamleshwar , J.P.Shukla and S.P.Trivedi.2005. *Fundamentals of Toxicology*. New Central Book Agency (P) Ltd. Kolkata, India

Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Robert May & Angela Mc Lean 2007 Theoretical Ecology. Principles and Application , Oxford University press (India Ed.)

Santra ,S.C. 1994. *Ecology Basic and Applied*. M.D. Publications Pvt. Ltd. New Delhi.

Sharma, P.D. 2007. Ecology and Environment. Rastogi Publishers

Stern, Nicholas. 2006. The *Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge, UK.

Stiling Peter, 2002. Ecology: Theories and applications. Prentice Hall of India pvt. Ltd. New Delhi

23U5PRZOO03: PRACTICAL 3
ENVIRONMENTAL BIOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyze the amount of Dissolved Oxygen and Dissolved Carbon Dioxide in water sample	PO1/PSO4	P	A	8
CO2	Analyze Zooplankton in a water sample qualitatively and quantitatively	PO1/PSO4	P	A/ An	8
CO3	Demonstrate the methodology for analyzing soil fauna	PO1/PSO4	P	A	2
CO4	Explain the mineral composition and ecological importance of rocks and minerals	PO1/PSO4	P	An	4
CO5	Demonstrate the technique of studying the water turbidity using Secchi's Disc and use of Plankton net	PO1/PSO4	P	An	4
CO6	Explain the structure and function of terrestrial, freshwater or marine ecosystems	PO1/PSO4	P	An	10

1. Estimation of dissolved oxygen
2. Estimation of dissolved carbon dioxide
3. Estimation of Soil Organic Carbon (Demonstration only)
4. Plankton count
5. Identification of freshwater/ marine plankton
6. Extraction of soil organisms (Demonstration only)
7. Identification of minerals and rocks
8. Secchi disc, Plankton Net
9. Compulsory Field Study report on one Terrestrial/Marine/Fresh water ecosystem

CORE COURSE 7 : EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY

Course Code	23U5CRZOO07
Title of the course	Evolution, Zoogeography and Ethology
Semester in which the course is to be taught	5
No. of credits	3
No. of contact hours	54

Objectives:

- To acquire knowledge about the evolutionary history of earth (living and non living)
- To learn various tools and techniques for evolutionary studies
- To study the distribution of animals on earth, its pattern, evolution and causative factors
- To impart basic knowledge on animal behavioural patterns and their role

Prerequisite:

- Basic knowledge on principles of inheritance and variation
- Knowledge on molecular basis of inheritance
- Basic understanding on the mechanism and factors affecting evolution
- Knowledge on origin and evolution of man,.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Understand origin of life on earth – (origin of universe, chemical evolution, Miller-Urey experiment&Haldane and Oparin theory) and various theories of organic evolution (Lamarckism, Weisman's germplasm theory, Mutation theory, Modern Synthetic theory(Neo Darwinism) and Neutral theory of molecular evolution)	PO1, PO4 PSO3	U	C	11
CO2	Analyze the different evidences (paleontological, biogeographical, Anatomical): forces (Variation and population genetics): products (speciation) stages and end (Mass extinction) of evolution	PO1 PSO3	A	C	21

CO3	Evaluate the basic concepts of oorigin of oceans and continents, zoogeographical realms, insular fauna, biogeography of India with special reference to Western Ghats and the types, means and barriers of animal distribution	PO1, PO4 PSO3	E	C	9
CO4	Understand the definition, history and scope of Ethology, different types of learning and basic concepts of sociobiology and evolution of human behavior	PO1 PSO3	U	C	13

PART I – EVOLUTION (32 hrs)

Module I

Theories of Origin of Life (5 hrs)

1. Special creation: 2. Extraterrestrial origin, 3. Spontaneous origin, 4. Theory of Biochemical Evolution: A) Chemical Evolution of life (Miller – Urey experiment, Oparin – Haldane theory), B) Biological evolution of life, C) Cognogeny, 5. Simple Beginnings: 6. RNA world, 7. Chilly start: 8. Deep-Sea Vents: 9. Community Clay: 10. Electric Spark

Module II

Theories of organic evolution (6 hrs)

1, Lamarckism - Critical analysis of Lamarck's propositions, 2. Weisman's germplasm theory, 3. Mutation theory. 4. Darwinism - Critical analysis of Darwinism, 5. Modern Synthetic theory (Neo Darwinism), 6. Neutral theory of molecular evolution

Module III

Evidences of evolution (6 hrs)

1. Paleontological (methods of fossil study - *Archaeopteryx lithographica*, significance of fossil study) 2. Biogeographical (geological time scale, evolution of horse) 3. Anatomical (Vestigial, homologus and analogous organs with examples – concept of convergent, divergent and parallel evolution, Atavism)

Module IV

Forces of evolution (4 hrs)

1. Variation as a raw material of change (Neo Darwinism), 2. Population genetics (Mendelian population, gene pool, gene frequency or alleilic frequency, genotype frequency, Hardy Weeinberg law, evolutionary forces in a population –Natural selection, genetic drift, mutation, gene pool)

Module V

Stages in evolution (3 hrs)

1. Microevolution, 2. Macroevolution, 3. Megaevolution

Adaptive radiation (causes, Darwin finches, adaptive radiation in mammals)

Module VI

Product of Evolution (6 hrs)

Speciation, Mechanisms of speciation – Allopatric; sympatric; peripatric, Patterns of speciation – Anagenesis and Cladogenesis; Phyletic Gradualism and Punctuated Equilibrium (Quantum Evolution), Basis of speciation – Isolating mechanisms

Module VII

End of Evolution (2 hrs)

1. Extinction, 2. Periodic extinctions, 3. Mass-scale extinctions – Causes and events

Core Readings

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.(Module 2,3 and 5)

Bull J.J and H.A.Wichman.2001.Applied Evolution. *Annu.Rev.Ecol.Syst.* 32:183-217 (Visit the Annual Reviews home page at www.AnnulReviews.org.)

Chattopadhyay Sajib.2002. *Life Origin, Evolution and Adaptation*. Books and Allied (P) Ltd.Kolkata,India.

Goodwin,B. 1996. *How the Leopard Changed its Spots: The Evolution of Complexity*. Simon &Schuster, NY,USA. (Module 4 & 5)

Jerry A.Coyne and H.Allen Orr.2004. *Speciation*. Sinauer Associates (Module 4)

Rob Desalle and Ian Tattersall 2008.*Human Origins: What Bones and Genomes Tell Us about Ourselves*. Texas A&M University Press, USA. (Module 3 & 4)

Sean B. Carroll and David M. Kingsley .2005 *Evolution: Constant Change and Common Threads*. Holiday Hrs on Science. Webcast or DVD available at www.hhmi.org/biointeractive/evolution. (Module 3 & 4)

Strickberger, M.W.2000. *Evolution*. Jones and Bartlett, Boston. (Module 1-7)

Verma P.S. and Agarwal V.K 2007 *Cell biology, Genetics, Molecular Biology, Evalution and Ecology,* S. Chand & Company New Delhi (Module 1-7)

PART II – ZOOGEOGRAPHY AND ETHOLOGY (22hrs)

Module VIII

Zoogeography: Introduction (5 hrs)

Origin of oceans and continents - Platetectonics – continental drift

Zoogeographical realms

Insular fauna-Continental Islands eg Medagascar and Oceanic Islands eg Galapagos.

Biogeography of India – with special reference to Western Ghats

Module IX

Animal distribution (4 hrs)

Types and means of animal distribution

Barriers in animal distribution.

Core Readings

Zoogeography

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

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

Chandran, Subash M .D.1997. On the ecological history of the Western Ghats. *Current Science*, Vol.73, No.2.146-155.

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.

Mani, M.S. 1974.*Ecology and Biogeography of India*. Dr. W. Junk b..v. Publishers , The Hague.

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

Ramesh,B.R and Rajan Gurukkal., 2007.*Forest Landscapes of the Southern Western Ghats, India Biodiversity, Human Ecology and management Strategies*. French Institute of Pondicherry, India.

Tiwari, S. 1985. *Readings in Indian Zoogeography, (*Module VI)

Module X

Ethology (1 hr)

Definition, History and scope of ethology

Module XI

Learning and imprinting (8 hrs)

Types of learning with examples

Experiments by K. Lorenz

Module XII

Ethology of man (4 hrs)

Sociobiology and evolution of human behaviour

Primates and human socio groups

Human pheromones

Core Readings

Bonner, J.T. 1980. *The Evolution of Culture in Animals*. Princeton University Press..NJ,USA. (Module 10)

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)
Dunbar,R. 1988. *Primate Social Systems*.Croom Helm,London. (Module 10 & 11)
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)
Zoological Society of Kerala Study material. 2002. *Environmental Biology and Ethology* Published by Zoological Society of Kerala (Module 6, 7, 8 & 9)

Selected Further Readings

Evolution

Barnes, C.W. 1988. *Earth, Time and Life*.John Wiley &Sons, NewYork
Bendall , D. S. (ed.)1983.*Evolution from Molecules to Man*. Cambridge University Press,U.K.
Bull J.J and H.A.Wichman.2001.Applied Evolution. *Annu.Rev.Ecol.Syst.* 32:183-217 (Visit the Annual Reviews home page at www.AnnulReviews.org.)
Chattopadhyay Sajib.2002. *Life Origin, Evolution and Adaptation*. Books and Allied (P) Ltd.Kolkata,India.
Goodwin,B. 1996. *How the Leopard Changed its Spots: The Evolution of Complexity*. Simon &Schuster, NY,USA.
Jerry A.Coyne and H.Allen Orr.2004. *Speciation*. Sinauer Associates
Rob Desalle and Ian Tattersall 2008.*Human Origins: What Bones and Genomes Tell Us about Ourselves*. Texas A&M University Press, USA.
Sean B. Carroll and David M. Kingsley .2005 *Evolution: Constant Change and Common Threads*. Holiday Hrs on Science. Webcast or DVD available at www.hhmi.org/biointeractive/evolution.
Strickberger, M.W.2000. *Evolution*. Jones and Bartlett, Boston.

Ethology

Bonner, J.T. 1980. *The Evolution of Culture in Animals*. Princeton University Press.NJ, USA.
David McFarland. 1999. *Animal Behaviour*. Pearson Education Ltd. Essex, England.
Dawkins, M.S. 1995.*Unravelling Animal Behaviour*. Harlow: Longman.
Dunbar, R. 1988. *Primate Social Systems*.Croom Helm, London.
Manning Aubrey and Marian Stamp Dawkins 1998*. An Introduction to Animal Behaviour*.Cambridge University Press,UK.
Paul W. Sherman and John Alcock.,2001 Exploring Animal Behaviour- Readings from American Scientist 3rd Edn. Sinauer Associates Inc. MA,USA.
Thomas A P (Editor)2011 Evolution, Zoogeography and Ethology. Green leaf publications TIES Kottayam.
Wilson, E.O. 1975. Sociobiology. Harvard University Press, Cambridge, Mass. USA.

23U6PRZOO03: PRACTICAL 3
EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Differentiate zoogeographical realms using map	PO1, PO4 PSO4	A	P	4
CO2	Differentiate endemic species of each realm	PO1, PO4 PSO4	A	P	4
CO3	Differentiatedifferent stages of horse evolution	PO1, PO4 PSO4	A	P	4
CO4	Differentiate Homologous and Analogous organs	PO1, PO4 PSO4	A	P	4
CO5	Analyse various connecting links	PO1, PO4 PSO4	A	P	4
CO6	Analyse pheromone traps	PO1, PO4 PSO4	A	P	4
CO7	Differentiate Skinner box and T Maze& different types of behaviour	PO1, PO4 PSO4	A	P	6
CO8	Analyse phototaxis and chemotaxis in Drosophila/Housefly	PO1, PO4 PSO4	A	P	6

1. Identification of Zoogeographical realms using map
2. Study on endemic species of each realm
3. Identification of different stages of horse evolution
4. Study on Homology / Analogy
5. Study on connecting links
6. Pheromone traps
7. Skinner box/T Maze
8. Identification of behaviour showing pictures
9. Experiment to demonstrate phototaxis using Drosophila/House fly
10. Experiment to demonstrate chemotaxis using Drosophila/House fly

CORE COURSE 8 : BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

Course Code	23U5CRZOO08
Title of the course	Biochemistry, Human Physiology and Endocrinology
Semester in which the course is to be taught	5
No. of credits	4
No. of contact hours	54

Objectives:

1. This course will provide students with a deep knowledge in biochemistry, physiology and endocrinology.
2. Defining and explaining the basic principles of biochemistry useful for biological studies for illustrating different kinds of food, their structure, function and metabolism.
3. Explaining various aspects of physiological activities of animals with special reference to humans.
4. Students will acquire a broad understanding of the hormonal regulation of physiological processes in invertebrates and vertebrates.
5. By the end of the course, students should be familiar with hormonal regulation of physiological systems in several invertebrate and vertebrate systems.
6. This also will provide a basic understanding of the experimental methods and designs that can be used for further study and research.
7. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Summerize the structure, biological importance and metabolism of important carbohydrates, protein and lipids and explain the mechanism of enzyme action and role of enymes in metabolism.	PO1 PSO3	U	C	16

CO2	Illustrate the importance of balanced diet, role of vitamins and minerals in diet and nutritional disorders and describe the functional aspects of respiration and repiratorydisorders	PO1 PSO3	U	C	10
CO3	Discuss the functional aspects of cardiovascular circulation, disorders related to it and the clinical aspects.	PO1 PSO3	U	C	9
CO4	Illustrate the structure and function of human nitrogenous excretory organs and renal disorders.	PO1 PSO3	U	C	6
CO5	Describe structure and functional facets of neuro muscular system and physiological features of sports and exercise and summerize the functional aspects of endocrine glands and the disorders associated with it.	PO1 PSO3	U	C	13

Part I. BIOCHEMISTRY (18 Hours)

Module 1

General Biochemistry, Bioelements And Biomolecules (4 hrs)

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

Core Readings

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Module 2

Metabolism (9 hrs)

Carbohydrate metabolism- Glycolysis, glycogenolysis, gluconeogenesis, glycolysis –citric acid cycle, ATP synthesis, Gycogenesis, Pentose phosphate pathway

Lipid metabolism- Biosynthesis and oxidation of fatty acids- Beta oxidation, Physiologically important compounds synthesized from cholesterol.

Protein metabolism- Deamination, transamination, transmethylation, decarboxylation.

Core Readings

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Module 3

Enzymes (4 hrs)

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

Core Readings

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Part II. HUMAN PHYSIOLOGY 26 Hrs

Module 4

Nutrition (5 hrs)

Nutrients, classification, RDA, Balanced diet.

Antioxidants and functions, Mineral metabolism, Role of Ca, Fe, Na, K and P. Role of vitamins

Food adulteration, Defects of modern food habits (importance of fibers in food), weight control, nutrition during pregnancy, breast feeding, anorexia, acidity and ulcers, flatulence, fasting and its significance, malfunctions of gastro intestinal tract.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.718-833 Prosser & Brown 2006 : Comparative Animal Physiology

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 5

Respiration (5 hrs)

Gas transport, Factors affecting transport of respiratory gases through blood, 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.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp432-509 Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 6

Circulation (4 hrs)

Cerebral circulation, Mammalian Heart structure, Nurogenic and Myogenic heart, blood brain barrier, Haemo dynamic principles, Blood composition, blood clotting mechanism – intrinsic and extrinsic pathways, clotting factors, anticoagulants, blood transfusion (safety and security problems), mention haemostasis, haemolysis, jaundice, thrombosis, ESR.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.144-262, 382-429, 711-715.

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 7 –EXCRETION **4 hrs**

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.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.264-379

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 8-MUSCLE PHYSIOLOGY **4 hrs**

Ultra structure of striated muscle.Mechanism of muscle contraction.Biochemistry of muscle contraction,isotonic and isometric contraction.

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.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.52-86

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 9 –NEUROPHYSIOLOGY **4hrs**

Synaptic transmission (in detail)& properties of synapses,Types of synapses, neurotransmitters, role of dopamine and serotonin. EEG, memory, short term and long term sleep, dream, Neural disorders- dyslexia, Parkinson's disease, epilepsy, Alzheimer's disease, schizophrenia.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.512-715

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Part III ENDOCRINOLOGY **11 hrs**

Module 11 **5 hrs**

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

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.836-966

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 12 **6 hrs**

Secretion, Regulation, Functions and Disorders of hormones of Hypothalamus, Hypophysis, Pineal, Thyroid, Parathyroid, Thymus, Islets of Langerhans, Adrenal, Gonads, Placenta, Gastro intestinal hormones.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.836-966

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Selected Further Readings

Human Physiology

Best and Taylor: Physiological basis of Medical practice

Chakrabarti, Ghosh &: Human Physiology, the New Book StallSchana.

Chatterjee C.C.: Human Physiology, Vol I & II Medical Allied Agency

Eckert &Randall : Animal Physiology, Mechanism &Adaptations , CBS pub, N. Delhi.

Ganong W F : Review of Medical Physiology, Mc Graw Hill, New Delhi.

Guyton : Text Book of Medical Physiology Saunders

Joshi : Nutrition and Dietetics , Tata Mc. Graw Hill

Knut Schmidt Nilesen 2007 Animal Physiology – Adaptation and environment. Cambridge University press 5 th ed.

Mackenna &Callander : Illustrated Physiology, Churchill Livingstone

Powar Human Physiology

Prosser &Brown : Comparative Animal Physiology

Sarada Subramanyam & K. Madhavankutty : Textbook of human physiology, S. Chand & Co Ltd, New Delhi.

Endocrinology

Barrington, E.J.W. General and Comparative Endocrinology, Oxford, Clarendon Press.

Bentley, P.J.Comparative Vertebrate Endocrinology, Cambridge University Press.

David O. Norris Vertebrate Endocrinology 3th Edition,

Gorbman ,A*et. al.* Comparative endocrinology, John Wiley &Sons.

Hadley, M.E. 2000. Endocrinology, 5th ed. Prentice Hall, Upper Saddle River, NJ. Martin, C.R. Endocrine Physiology, Oxford University Press

Norris, D.O. 1997. Vertebrate Endocrinology, 3rd ed. Academic Press, Sand Diego, CA.

Williams, R.H. Textbook of Endocrinology, W.B. Saunders

Biochemistry

Ackerman E, Biophysical Science, Prentice Hall Inc.

Awapara J, Introduction to Biological chemistry, Prentice-Hall of India

Cohn E E and Stumpf P K, outlines of Biochemistry, Wiley Eastern

Foster, R.L. Nature of Enzymology

Garett and Grisham. Biochemistry.
Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill
Lehninger, Biochemistry , Kalyani Publications
Lodish et. al. Molecular Cell Biology
Rangnatha Rao K, Text Book of Biochemistry, Prentice-Hall of India
Roy K N, A Text Book of Biophysics, New Central Book Agency
Stryer, Biochemistry, W.H Freeman and Co., Newyork
Voet, D. and J.G. Voet. Biochemistry. J. Wiley & Sons

23U6PRZOO04 : PRACTICAL 4
BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyse the haemoglobin content of human blood and also Analyse the RBC and WBC count using haemocytometer.	PO1 PSO4	An	P	12
CO2	Analyse the Packed cell volume of the given blood sample and to study the effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.	PO1 PSO4	An	P	8
CO3	Application of sphygmomanometer, stethoscope and kymograph.	PO1 PSO4	An	P	4
CO4	Analyse the brain of cockroach and study the human endocrine disorders.	PO1 PSO4	An	P	8
CO5	Analyse the chemical nature of biological fluids.	PO1 PSO4	A	P	4

PHYSIOLOGY

1) Determination of haemoglobin content of blood
2) Total RBC count using Haemocytometer
3) Total WBC count using Haemocytometer
4) Estimation of PCV
5) Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.
6) Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use)

Measurement of blood pressure using a sphygmomanometer (demonstration)

ENDOCRINOLOGY

1. Cockroach – Corpora cardiaca & Corpora allata (Demonstration)
2. Human hormonal disorders (Diagrams/Photographs)

BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipids.

CORE COURSE 9 : REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

Course Code	23U6CRZOO09
Title of the course	Reproductive and Devolopmental Biology
Semester in which the course is to be taught	6
No. of credits	3
No. of contact hours	54

Objectives

1. This will provide a basic understanding of the experimental methods and designs that can be used for further study and research.
2. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Understand the definition, sub-divisions, terms, early history, applications and scope of embryology	PO1/PSO3	U	C	16
CO2	Understand the concepts of gametogenesis, fertilization, cleavage, blastulation, gastrulation, fate maps and egg types	PO1/PSO3	U	C	14
CO3	Understand the embryology of human, chick, frog and drosophila	PO1/PSO3	U	C	15
CO4	Understand the sexual cycle	PO1/PSO3	U	C	4
CO5	Understand the experimental embryology and regeneration in animals	PO1/PSO3	U	C	4

CO6	Understand the concept of teratology	PO1/PSO3	U	C	1
CO7	Understand the birth and developmental defects	PO1/PSO3	U	C	2

Module I

Introduction (10 hrs)

Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Mossaic theory, Regulative theory, Germplasm theory (Weisman) , Branches of embryology (Descriptive embryology , comparative, Experimental, chemical Embryology and Teratology) . Scope of Developmental biology

Gametogenesis.

Spermatogenesis (brief account), Structure of sperm. Oogenesis (brief account), structure of Egg . significance of gametogenesis.

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, symmetry and egg content.

Fertilization

Fertilization features, External fertilization . Mechanism to block polyspermy. Internal fertilization . capacitation, amphimixis. Parthenogenesis (brief account) natural and artificial. Arrhenotoky, Thelytoky . Significance of Fertilization .

Module II

Cleavage (12 hrs)

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

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)

Module III

Embryology of Frog (3 hrs)

Gametes, Fertilization, Metamorphosis of frog, cleavage, blastulation, gastrulation, development of Eye in frog

Module IV

Embryology of chick (5 hrs)

Structure of egg, fertilization, cleavage, blastulation, gastrulation. Mention brief account of 18 hour chick embryo ,24 hour chick embryo, 33 hour chick embryo and 48 hour chick embryo. Extra embryonic membranes in chick.

Module V

Human development (10 hrs)

Human reproductive organs (brief account only)

Sexual cycle

Estrus cycle (non-primate) and menstrual cycle (primate cycle). Hormonal control of menstrual cycle. Gametes, Blastocyst, Morula, Implantation, foetal membranes and placenta formation. 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.

Module VI

Embryonic development of Drosophila (2 hrs)

Early embryonic development (brief account only), control of genes over developmental process (segmentation genes and Homeotic selector gene).

Module VII

Post Embryonic development (3 hrs)

Metamorphosis – Types in insects, Amphibian metamorphosis (brief account only) – Regeneration in animals **-** General survey of regeneration among animals, different types of regeneration

Module VIII

Experimental embryology (2 hrs)

Spemann's constriction experiments, Organizer and embryonic induction.

Module IX

Applications of embryology (4 hrs)

Contraception & birth control,Prenatal diagnostic techniques and PNDT Act, Death (miscarriage and still birth), Abortion – biological aspects, Intrauterine Growth Retardation (IUGR)

Assisted fertilization, Invitro fertilization (test tube baby), Embryo transfer technology (Cattle and man), Cloning. Cryopreservation of semen and embryo

Module XI

Teratology / Dysmorphology (3 hrs)

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

Core Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Harrison , Harriosns Book of Internal Medicine Church Livingston 17th Ed.

Majumdar N. N - Vetebrate embryology

Vijayakumaran Nair K. and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Selected Further Readings

Berril, N.J and Kars G. 1986. Developmental biology, Mc Graw Hills

Berry A. K - An introduction to embryology.

Gibbs (2006). Practical guide to developmental biology.

Gilbert S. F - Developmental biology

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Jain P. C - Elements of developmental biology.

John Rigo Fundamental Genetics Cambridge University Press. 2009

Julio Collado Vides & Relf Hofestadt Gene Regulation and Metabolism Post genomic Computated Approaches, Ane Book 2004

Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford university press (Int. student edition) 2006

Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New Delhi.

Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008

Werne A Muller. Dev. Biology, Springer Verlay New York 2008

Web Resources

www.Wikipedia.com. (Module IV)

www.medpedia.com. (Module IV)

23U6PRZOO05 : PRACTICAL 5
REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyze the development of frog, chick and Drosophilla	PO1/PSO4	An	P	8
CO2	Analyse the developmental stages of Drosophila and the life cycle from fruit fly stock culture	PO1/PSO4	An	P	6
CO3	Analyse Mammalian Development; placenta of pig and man	PO1/PSO4	An	P	4
CO4	Analyse the embryological techniques	PO1/PSO4	An	P	4
CO5	Candling of chick egg–Analyse whether the egg is fertilised or not	PO1/PSO4	An	P	4
CO6	Analyse the male and female reproductive system of a teleost fish / cockroach	PO1/PSO4	An	P	8

1. Development of Frog - cleavage stages, blastula, gastrula, neurula, tadpole (Charts/ permanent slides may be used for study).
2. Development of Chick - primitive streak stage, 24th hour, 33 hour and 48 hour chick embryo (Charts/ permanent slides may be used for study)
3. Development of Drosophila - Study the developmental stages and the life cycle from fruit fly stock culture
4. Mammalian development - Sections of Testis and Ovary (Mammalian), Study of placenta- pig and man
5. Study of the following embryological techniques - Amniocentesis, Embryo transfer, IVF, cloning (models/charts/ pictures may be used)
6. Candling of chick egg.
7. Study of male and female reproductive system of a teleost fish/cockroach (Dissect and display, sketch and label)

23U6CRZOO10: CORE COURSE 10
GENETICS AND BIOTECHNOLOGY

Course Code	23U6CRZOO10
Title of the course	Genetics and Biotechnology
Semester in which the course is to be taught	6
No. of credits	3
No. of contact hours	54

Objectives of the Course

1. To emphasize the central role that genetics and biotechnology plays in the life of all organisms.
2. To introduce the student to some of the present and future applications of bio-sciences
3. To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Describe the scope and importance of genetics, brief explanation of terms and laws of genetics. Explain gene interactions. Linkage and recombination of genes	PSO2	U	C	12
CO2	Explain and summarize sex determination in man, honey bees, hormonal influence and environmental influence on sex and study of mutations, its types and molecular basis of mutations and understanding the concept of extra nuclear inheritance	PSO2	U	C	9
CO3	Describing bacterial genetics and Human Genetics	PSO2	U	C	12
CO4	Explaining biotechnology, scope, importance, basic aspects of genetic engineering, tools, vectors, DNA isolation, techniques in gene transfer	PSO2	U	C	7

CO5	Describing general techniques in biotechnology, gene cloning, blotting techniques, hybridization techniques, stem cultures and practical applications of biotechnology and problems and hazards of genetic engineering	PSO2	U	C	14

PART I GENETICS (33 hrs)

Module I

Introduction (4 hrs)

Scope and importance of genetics, Brief explanation of the following terms- gene, alleles, genotype, phenotype, genome, homozygous and heterozygous, wild type and mutant alleles, dominant and recessive traits, test cross and back cross, reciprocal cross, Mendelism – Mendel's laws , Mendelian traits in man Chromosome theory of heredity.

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 1 &2.

Module II

Interaction of genes (5 hrs)

Allelic and non Allelic. Allelic- incomplete dominance Co-dominance Non allelic interactions, – complementary, supplementary, epistasis – dominant (feather colour in fowl) and recessive (coat colour in mice) Polygenes (Skin colour inheritance in man) pleiotropism, modifying genes, lethal genes (Brief account with one example each) Multiple alleles(eg) Coat Colour in rabbits. Man ABO blood group Rh factor, Blood group and its inheritance (Genetic problems related to this topic are included in practicals)

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 3 &4.

Module III

Linkage and Recombination (3 hrs)

Linkage and recombination of genes based on Morgan's work in Drosophila (Complete and incomplete linkage). Linkage map Chromosome mapping. Basic steps of construction of gene map

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 5

Module IV

Sex determination (3 hrs)

Chromosome theory of sex determination (sex chromosomes and autosomes) chromosomal mechanism (XX-XO, XX-XY, ZW-ZZ) : Sex determination in man- role of Y chromosome. Sex determination in honey bees. Genic balance theory. Drosophila- intersex, gynandromorphs. Hormonal Influence on sex determination Environmental influence - Hermaphroditism

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 6

Module V

Mutations (4 hrs)

Mutations, Types of Mutations. Germinal, Sex linked mutations. Chromosomal mutations - structural and numerical changes. Gene mutation (point mutation) Molecular basis of gene mutations – tautomerism- Induced mutations Physical and chemical mutagens

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology

Gardner E.J. & Snustand D.P 1984. *Principles of Genetics* (John Wiley &Sons) New York

Module VI

Extra nuclear inheritance (2 hrs)

Cytoplasmic inheritance Characteristics: Organellar DNA (Mitochondrial and plastid DNA) Kappa particles in paramecium.

Core Readings

Vijayakumaran Nair 2006, *Genetics and Molecular Biology.* Continental Publications, Trivandrum.

Module VII

Bacterial genetics (5 hrs)

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

Core Readings

Panicker S. Abraham G and Francis G. 2008. *Microbiology and Immunology* Published by Zoological Society of Kerala Chapter 10

Ananthanarayanan & Jayaram Panicker, 2006. *A textbook of Microbiology*. Orient Longman pvt. Ltd

Module VIII

Human Genetics (7 hrs)

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 (Klinefelter's

syndrome, and Turners syndrome) Single gene disorders Gene mutation and disorders (Brief mention) Autosomal single gene disorders (Sickle cell anaemia, brachydactyly; inborn errors of metabolism such as phenyle ketonuria, alkaptonuria). Sex linked inheritance. Definition - characteristics criss-cross 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.

Core Readings

Stern C. 1973. Principles of Human Genetics (W.H. Freeman and Co.)
Veer Bala Rastogi – Fundamental of Mol. Biology Ane students Education 2008
Verma P.S. and Agarwal V.K. 1988 Genetics (S. Chand and Co. New Delhi)
Winchester A.M. 1966. Genetics (Oxford & IBH Publications).

PART II BIOTECHNOLOGY (21 hrs)

Module IX

Introduction (1 hr)

Definition and scope of Biotechnology

Core Readings

Sudha Gangal- Principles & Practice of Animal Tissue Culture. University Press. Pp- 128-135

Module X

Basic aspects of Genetic Engineering (6 hrs)

Tools-Enzymes-Restriction enzymes and DNA ligases.
Vectors-Plasmids and Phage vectors.
Isolation of gene/DNA.
Techniques-Production of recombinant DNA. Briefly mention
rDNA transfer and screening methods. Cloning in host cells. Virus mediated gene transfer, DNA mediated gene transfer.

Module XI

General Techniques in Biotechnology (6 hrs)

Techniques in gene cloning; PCR technique and DNA Amplification.
Blotting Techniques- Southern Blotting, Northern Blotting, Western Blotting
Identification of DNA, mRNA, and Protein.
DNA hybridization, Fluorescence *insitu* Hybridization (FISH), Colony hybridization.
DNA finger printing and its applications.
RFLP- markers Applications. Gene libraries, Genomic and cDNA libraries Human DNA library, Construction of genomic library and cDNA library.

Stem cells (Totipotency, Pleuripotency, Unipotency) and human ES cell cultures, Human EG cell cultures and Human EC cell cultures and stem cell research. Therapeutic cloning and Reproductive cloning. Potential uses of stem cells. Ethical issues related to embryological experiments.

Core Readings

John Ringo 2009 *Fundamental Genetics* Cambridge University Press, Chapter 29.

Sobti & Sharma 2008 *Essentials of Modern Biology* Ane's Student Edition Chapter 2 p. 89

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology , Published by Zoological Society of Kerala

Wilson & Walker 2008 *Biochemistry and Molecular Biology* 6th edition, Cambridge University Press. Chapter -5

Veer Bala Rastogi – Fundamental of Mol. Biology Ane students Education 2008 Chapter 16 p. 379-424.

Module XII

Practical Applications of Biotechnology (5 hrs)

(Brief account only)

Bioremediation, Animal cell and tissue culture, Single cell protein (SCP) The economic implications of SCP.

Biotechnology and Medicine: Gene therapy – Somatic and germline gene therapy, Monoclonal antibodies, Pharmaceuticals and Biopharmaceuticals –Hormones(insulin, somatostatin), DNA Vaccines

Biotechnology in agriculture and forestry – Microbial insecticides, Resistance of plants to weedicides, insect pest and microbial diseases. Production of transgenic plants

Animal biotechnology – Genetic Engineering for transgenic animals.

Fermentation technology in food and beverages

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology , Published by Zoological Socieyt of Kerala

John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005

Singh B. D Biotechnology 2002, Kalyan Publishers New Delhi

Module XIII

Problems in Biotechnology (3 hrs)

Hazards of genetic engineering Problems of biologically active biotechnology products. Problems of biotechnological inventions: Patenting and Patent protection – Trade secrets Plant breeder's rights. Biowar and biopiracy

Core Readings

John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005

Singh B.D. Biotechnology 2002, Kalyan Publishers New Delhi.

Selected Further Readings

Bala Subramanian D., C.F & Bryle & K. Dharmarajan J. Green Kunthala Jayaraman, Concept in Biotechnology. University Press 2007

Benjamin Lewin 2004 Gene VIII Oxford University Press

Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford)

C.W. Fox, J.B. Wolf Evolutionary Genetics Concept of Case Studies, Oxford university Press 2006

Colin Ratledge & Bijorn Kristiansen, Basic Biotechnology 3 rd ed. Cambridge University (2008)

De Robertis E.D. and De. Robertis E.M. 1987 cell & Molecular Biology (Lea & Febya / Info- Med)

Desmand S.T. Nicholi An introduction to Genetic Engineering Cambridge Sec, Ed. 2007.

Frank H, Stephenson Calculation for Molecular Biology and Biotechnology . Academic press 2006

Gardner E.J. and Snustand D.P. 1984. Principles of Genetcis (John Wiley & Sons New York.)

Gerhard Fuchs. Biotechnology & in Corporative Perspective. Study in global Competition series, Ane Book 2003

Jan Vijay Aging of the Genome The dual role of DNA in life and Deaths. Oxford university Press 2008

Janarthanan S & Vincent S., Practical Biotechnology, Method of Protocols. University Press . 2007

John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005

Madingan , Martinko and Parker 2002, Biology of Microorganisms , Brock Eighth Ed. Prentice Hall

Powar. C.B. 1983. Cell biology (Himalaya Publishing company)

Prave D. Faustu and Sitting W and Subasten D.A (Eds) 1987 Fundamentals of Biotechnology (VCH publishers. Germany)

R.C. Sobte and Suparna. S. Pachauri. Essentials of Biotechnology Ane Book Pvt. Ltd. 2009

Singh B.D. Biotechnology 2002, Kalyan Publishers New Delhi.

Sinnat Dunn & Dobzhansky 1959. Principles of Genetics (T.M.H. New Delhi)

Stern C. 1973. Principles of Human Genetics (W.H. Freeman and Co.)

Strickberger W.M. 1990. Genetics (Mac Millan Publishing Co.)

Sudha Gangal Biotechnology Principles And & practice of Animal Tissue culture, Universities Press 2007

Susantha Gosnalibke – Merged Evolution (Long term implication of Biotechnology and Information Technology) Gordon & Breech Pub. 2005

Veer Bala Rastogi – Fundamental of Mol. Biology Ane students Education 2008

Verma P.S. and Agarwal V.K. 1988 Genetics (S. Chand and Co. New Delhi)

Winchester A.M. 1966. Genetics (Oxford & IBH Publications.

23U6PRZOO05 : PRACTICAL 5
GENETICS AND BIOTECHNOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Evaluating genetic problems – mono and dihybrid ratio, back cross and multiple alleles	PO1 PSO4	A	P	4
CO2	Analysis of human buccal epithelium	PO1 PSO4	A	P	2
CO3	Analyse the chromosomal anomalies in man, Examine the karyotype and idiogram of somatic metaphase chromosome in human, Analysing the sex in Drosophila	PO1, PO5 PSO4	A	P	4
CO4	Isolation of DNA	PO1, PO4 PSO4	A	P	4
CO5	Analysis of polymerase chain reaction, Analysis and study of the blotting techniques	PO1, PO4 PSO4	A	P	4

1. Genetic problems – (Problems from each type)

   (a)Mono and Dihybrid ratio (b) Back cross (c) Multiple alleles.

2. Study of barr body in human buccal epithelium

3. Study through photographs of the Karyotype - Turner's Syndrome , Klinefelters and Down's Syndrome

4. Study of the karyotype and idiogram from the given photograph of somatic metaphase chromosome-(Human)

5. Sexing of Drosophila melanogaster

6. Isolation of DNA (Demonstration)

7. Study of Polymerase Chain Reaction (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 nearby research institution / Biotechnology departments/ research centre, and see the demonstration of practicals 5, 6 7, and 8,/Video show if they do not have such facility in their institution)

Core Reading

S. Janardhanan and Vincent S.2008 *Practical Biotechnology Methods and protocols* Cambridge University Press.

CORE COURSE 11

MICROBIOLOGY AND IMMUNOLOGY

Course Code	23U6CRZOO11
Title of the course	Microbiology and Immunology
Semester in which the course is to be taught	6
No. of credits	3
No. of contact hours	54

Objectives of the course

1. To inspire the students in learning the frontier areas of biological sciences
2. To make them aware of the pathogens , health related problems, their origin and treatment.
3. To equip the students with the knowledge of modern developments and recent trends in biological sciences

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Become aware of the basic concepts of microbiology and immunology	PO1; PSO3	U	C	18
CO2	Apprehend the concept of infectious diseases, carriers and so on	PO1; PSO3	U	C	9
CO3	Elucidate the structure of immunoglobulins, their reaction with antigens and their applications.	PO1; PSO3	U	C	18
CO4	Illustrate with examples various disorders of immune system.	PO1; PSO3	U	C	9

PART I MICROBIOLOGY (27hrs)

Module1

Introduction (2hrs)

History and Scope of Microbiology; classification of bacteria and viruses

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunoloy, Study Material Series published by Zoological Society of Kerala
Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.
Kanika Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

Module 2

Methods in Microbiology (6 hrs)

Sterilization and disinfection- different methods, physical and chemical; Preparation of culture media (aerobic and anaerobic cultivation) Enriched media, selective media, differential media and enrichment media; Plating techniques and isolation of pure colonies; Culture preservation techniques.

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 1 p. 1-36
Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.
Kanika Sharma. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

Module 3

Bacteria Structure (5 hrs)

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

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 1 p. 1-36
Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.
Kanika Sharma. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

Module 4

Bacterial Growth (2 hrs)

Effect of various factors on bacterial growth, Nutritional requirements, bacterial count Bacterial growth curve

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 3
Ananthanarayan R & C.K. Jayaram Paniker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Kanika Sharma. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

Module 5

Basic Virology (3 hrs)

Viruses -Structure of Viruses -Animal, Plant and Bacterial Viruses. Replication of viruses.

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 2

Anthanarayan R & C.K. Jayaram Paniker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Kanika Sharma. Manual of Microbiology tools techniques 2nd Ed. Ane's student *Editions 2009*

Module 6

Infections (2 hrs)

Types- Primary and secondary infections, Cross infection, nosocomial infection, endogenous and exogenous infections.

Different modes of transmission of diseases -by food, water, air, vectors, and carriers; Contagious diseases - epidemic, endemic and pandemic; carriers and types- healthy carriers, convalescent carriers, temporary and chronic carriers, contact carriers, paradoxical carriers

Core Readings

Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunoloy, Study Material Series published by Zoological Society of Kerala Chapter 8.

Park K., Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasidass Bhenot Publications

Module 7

Diseases and Pathogens (7 hrs)

Diseases caused by different pathogens- epidemiology, symptoms, laboratory diagnosis and prophylaxis of bacterial, viral and fungal diseases: A brief study of two examples from each category bacterial: Tetanus & Typhoid; Viral : influenza and polio; Fungal: Dermatophytoses & Candidiasis

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 7

Ananthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Kanika Sharma. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

PART II IMMUNOLOGY

Module 8

Introduction to immunology (4 hrs)

Types of immunity- innate immunity- mechanism of innate immunity (eg. Barriers, Phagocytosis, inflammation.) -Acquired immunity- passive & active. Vaccines -types of vaccines- live, killed, toxoids, recombinant DNA. Adjuvants

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 1

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 9

Antigens Antibodies (6 hrs)

Antigens, haptens, antigenic determinants. Basic structure of immunoglobulins. Different classes of immunoglobulins and functions , Complements (brief)

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 4

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 10

Antigen-antibody reactions (4 hrs)

Precipitation test, Agglutination Test, Clinical applications of antigen -antibody reaction Eg: Widal, VDRL , ELISA test

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 4

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 11

Immune Response system (6 hrs)

Primary and secondary lymphoid organs. Cells of the immune system – Leucocytes, Lymphocytes- T & B cells, Macrophages, Plasma cells, Memory cells, MHC. Primary and secondary responses

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 4

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 12

Immunopathology- immune disorders (7 hrs)

Immunopathology- immune disorders (Hypersensitivity, autoimmunity and immunodeficiency)

Different types of hypersensitivity reactions

Autoimmunity, mechanisms of autoimmunization

A brief study on autoimmune diseases eg. Thyrotoxicosis, rheumatid arthritis

Immunodeficiency diseases- eg. AIDS

Transplantation Immunity - Graft rejection , major histocompatibility, Human leukocyte antigen system - (HLA)

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 4

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Selected Further Readings

Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Colemen: 2002 Fundamentals of Immunology

Darla J. Wise & Gordon R. Carter: 2004:Immunology A Comprehensive Review Iowa state University Press. A Blackwell science company,

Hans G. Sch Legal General Microbiology Seventh Ed. Cambridge Low Price Ed.

Helen Hapel, Maused Harney Siraj Misbah and Next Snowden: 2006 Essentials of Clinical Immunology Fifth Ed. Blackwell Publishing Company,

Heritage, J ., E.G.V. Evaus & R.A.Killungten 2007: Introductory Microbiology Cambridge University Press

Ivan Roitt: 2002 Essentials of Immunology ELBS.

K. Park, Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasidass Bhenot Publications

Kanika Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

Keith Wilson and John Walker, 2009, Principles and Techniques of Biochemistry and Molecular Biology Sixth Ed. Cambridge University Press

Mangi, E.M.T El. C.F.A Bryca, A.L Demain, A.K. Allman Fermentation Microbiology & Biotechnology Sec. Ed. Taylor Framics London New York 2006

Michael J. Pelczar ECS,Chan& Noel. R. Kreig, Microbiology, Tata McGraw Hill 5th ed. 1996.

Monica Cheesbrough: Laboratory Manual for Tropical Countries. Vol.II Microbiology, ELBS – Cambridge Ed. 1986.

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala.

Prakesh Arora M. Anes Illustrated Dictionary of Immunology, Ane Book India. 2002

Prescott. Microbiology 2nd edition

23U6PRZOO06 : Practical 06
MICROBIOLOGY AND IMMUNOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyse the working principles of various instruments used in microbiology lab	PO1 PSO4	A	P	4
CO2	Analyse the components of different media and their purposes.	PO1 PSO4	A	P	6
CO3	Use / apply different culture and staining techniques studied in microbiology classes as per requirements	PO1 PSO4	An	P	8
CO4	Explain the role of antigen antibody interactions in our body and the role played by various cells and organs of our immune system	PO1 PSO4	An	P	8

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)(Demonstration)
   (a) Solid media (1) Nutrient agar (2) Mac Conkey agar
   (b) Liquid Media (1) Nutrient broth (2) Peptone water.
   (c) Semi solid agar (d) Firm agar
4. Culture methods (Demonstration)
   (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 bacterial count in any one water sample (demonstration).
6. Examination of microbes in living condition
   (a) 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 –antibodyReaction)
11. Study through photographs/ illustration, the primary lymphoid (Bone marrow and thymus) and secondary lymphoid (spleen and lymph nodes) organs in Rat/Man.

CORE COURSE 12 : GENERAL INFORMATICS, BIOINFORMATICS, BIOSTATISTICS AND RESEARCH METHODOLOGY

Course Code	**23U6CRZOO12**
Title of the course	General Informatics, Bioinformatics and Biostatistics and Research Methodology
Semester in which the course is to be taught	6
No. of credits	3
No. of contact hours	54

Objectives of the course

1. To inspire the students in learning the frontier areas of biological sciences
2. To update and expand basic informatics skills and attitudes relevant to the emerging knowledge of society and also to equip the students to effectively utilize the digital knowledge resources in learning.
3. To equip the students with the knowledge of modern developments and recent trends in biological sciences
4. To familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences

Pre-requisite:

- An awareness on role of research in science

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Explain basic fundamentals of informatics and operating system and illustrate databases, sequence and genome analysis.	PO1 PSO4	U	C	12
CO2	Comprehend basics of proteomics and molecular phylogenetics and describe basic concept of computer Aided Drug Discovery and bioinformatics tools.	PO1 PSO4	U	C	10
CO3	Describe sampling techniques and comprehend measures of central tendency, dispersion,	PO1	U	C	14

	probability distribution and correlation.	PSO4			
CO4	Illustrate the tools and techniques in biological research.	PO1 PSO4	U	C	9
CO5	Explain the concept of research methodology.	PO1 PSO4	U	C	9

Part I GENERAL INFORMATICS (6 hrs)

Module 1.

Introduction (2 hrs)

Microprocessors – RAM, ROM, EPROM, Memory systems, input, output devices. Disk operating systems, booting, formatting.

Core Readings

Sinha, Pradeep K. and Sinha, Priti. [2003], *Computer Fundamentals – concepts systems and applications,* Third Edition, BPB publications, New Delhi.

Module 2

Operating systems (4hrs)

DOS, Windows, Linux (only basics), MS Office (MS word, Excel, Access and PowerPoint) computer programming, Networking (LAN, WAN), Internet, World Wide Web, Databases and information retrieval.

New technology in Internet

Core Readings

Gupta, Vikas [2002], *Comdex –computer course kit,* Eight Edition, Dramtech, New Delhi.

Part II BIOINFORMATICS (18 hours)

Module 3

Introduction (6 hrs)

Definition, Nature & Scope of Bioinformatics - Contrast between Bioinformatics and Computational Biology; Key Bio-sequences in Molecular Biology - DNA, RNA and Amino-acid sequences -Popular Databases in Bioinformatics - NCBI, DDBJ, PDB, OMIM, EMBL, INSDC; BLAST & FASTA sequence file formats, Approach of Comparative Biology based on sequence comparison - The basic idea of sequence comparison (algorithms not required) - idea of scoring matrices

Core Readings

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003

2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.

3. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

Further Readings:

1. Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.
2. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
3. Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.

Module 4

Search Engines and Sequence alignment (6 hrs)

The Blast search engine - important features - Idea of Multiple sequence alignment – Proteomics: Basic ideas of Protein Structure prediction- Concept of Homology Modeling- Idea of Molecular Phylogenetics - advantages and computational procedure (only description of use of a package such as Phylip)-

Core Readings

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003
2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.
3. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

Selected further Readings

1. Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.
2. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
3. Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.

Module 5

Drug discovery (6 hrs)

Basic concepts of computer Aided Drug Discovery- General description of drug discovery pipeline- concept of Personalized medicine; Bioinformatics tools: (i)Molecular Visualization Software - Rasmol (Basic features only) - (ii) ORF finding (iii) gene finding, (iii) BLAST (iv) Hydrophobicity Prediction (v) Single Nucleotide Polymorphism (SNP) prediction using GENSNIP

Core Readings

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003
2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.
3. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

Selected further Readings

1. Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.
2. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
3. Xiong, Jin. [2006], *Essential Bioinformatics,* Cambridge University Press, New York.

Module 6

Future Prospects (2 hrs)

1. Human brain Project
2. Computer simulation and visualization of molecular structure
3. Protein structure prediction.

Core Readings

Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.

Part III BIOSTATISTICS (18 hrs)

Module7

Sample & Sampling techniques (2 hrs)

Collection of data, Classification of data, Frequency distribution tables,
Graphical representation - Bar diagrams, Histogram, Pie diagram and Frequency curves.

Core Readings

Dutta, Naren. [2002], *Fundamental of Biostatistics- Practical Approach,* Kanishka Publishers, New Delhi.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 8

Measures of Central Tendency (3 hrs)

Mean, Median, Mode (Direct method only, with merits and demerits)

Core Readings

Dutta, Naren. [2002], *Fundamental of Biostatistics- Practical Approach,* Kanishka Publishers, New Delhi.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 9

Measures of dispersion (4 hrs)

Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits).

Core Readings

Dutta, Naren. [2002], *Fundamental of Biostatistics- Practical Approach,* Kanishka Publishers, New Delhi.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 10

Probability Distributions (3 hrs)

Normal, Binomial, Poisson distribution (Brief description only)

Core Readings

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 11

Correlation (4 hrs)

Definition, Types of correlation (Simple problem)

Core Readings

Campbell, R.C. [2005], *Statistics for Biologists, Cambridge Universtiy Press,* New York.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 12

Test of Hypothesis and Test of Significance (2 hrs)

Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis. Chi- square test.

Core Readings

Campbell, R.C. [2005], *Statistics for Biologists, Cambridge Universtiy Press,* New York.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Selected Further Readings

Campell, R. 1990. Statistics for biologists. CBS Publishers and distributors.

Chavali. L.N. 2009 Bioinformatics & Bioprogramming in Cambridge University press

David. G. Kleinbaum and Mitchel Klein 2009 Survival analysis Statistics for Biology & Health 2nd .Ed. Springer International ed.

Jin Xiang 2008 Essential Bioinformatics 1st Ed. Cambridge University Press.

Khan and Khanum, 1990 Fundamentals of biostatistics

Neil C.Jones and Pavel A.Pevzner. 2004An introduction to Bioinformatics Algorithms. Ane Book Pvt Ltd.

Nikolay Kolchamvov and Ralf Hofestaedt-2008 Bioinformatics of Genome Regulation and structure. Springer international Ed.

Norman T.J. Bailey Statistical methods in biology 2007 Cambridge University press.

Paul.G. Hegg's and Teresa .K. Altwood- 2005., Bioinformatics and Molecular Evolution Blackwell publishers.

Pennington S.R. and M.J.Dunn.Proteomics.2005 Ane Books.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Warren J.Ewens, Gregory .R.Grant. 2008. Statistical methods in Bioinformatics an Introduction

Part IV RESEARCH METHODOLOGY (12 hrs)

Module I

Tools and Techniques in Biological Research (7 hrs)

Scientific drawing -Purpose and principle

Basic understanding on principle and uses of the following:

Microscopy – A) Light microscopy, Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polorization microscopy, Video microscopy.

B) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers, Camera Lucida, Instrumentation - pH Meter
Separation Techniques – Centrifuge, Chromatography, Electrophoresis
Analytical techniques – Colorimeter, Spectrophotometer, X-ray crystallography

Core readings

Aggarwal S.K, 2009 *Foundation Course in Biology* Ane's Students Edition P- 79-93.
Eldon D. Enger, Frederick C. Ross and David Bailey 2008(Eleventh Edition) *Concepts in Biology.* Tata – McGraw Hill, New Delhi
Taylor, Green, Stout (2008) Biological Science, Cambridge University, Press, p 161-163
Wilson & Walkar 2008 *Principles and Techniques of Biochemistry and Molecular Biology* Cambridge University Press. Chapters 9,10,11,15.
Zoological Society of Kerala Study Material 2002 – *Cell Biology, Genetics & Biotechnology*. Chapter-2 Tools and Techniques.

Module II

Research Methodology (4 hrs)

Scientific method
Research Projects- Steps and process. Types.
Research Communication
Research report writing (Structure of a scientific paper)
Presentation techniques
Project proposal writing
Assignment, seminar, debate, workshop, colloquium, Conference - Brief description and major differences

Core Readings

Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing. Wiley Eastern Ltd.
Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition: Oxford University Press. Chapters.1-8.
Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it. Narosa Publishing House.
Ruxton, G.D. and Colegrave, N. 2006. Experimental design for the life sciences. Oxford University Press. Chapters 1-6.

Module III

Units of measurements (1 hr)

Calculations and related conversions of each:
Metric system- length; surface; weight, Square measures, Cubic measures (volumetric), Circular or angular measure, Concentrations- percent volume; ppt; ppm, Chemical – molarity, normality, Temperature- Celsius, centigrade, Fahrenheit

Core readings

D.K. Illustrated Oxford Dictionary.2006 Chapter on Measurements p-968.
Knut Schimidt – Nielsen 2007 *Animal Physiology,* 5th Edition, Appendix -A

Taylor D.J. Green N.P.O, Stout G.W. Editor R. S. Oper, 2008 Biological science (Third edition Cambridge University press. P-960

Selected Further Readings

Aggarwal. S.K. 2009 Foundation Course in Biology, 2nd Ed.. Ane's Student Edition. Ane Books Pvt. Ltd.

Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing. Wiley Eastern Ltd.

Bowler Peter J., and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey*. University of Chicago Press, Chicago, IL:

Day, R.A. 1993. How to write and publish a scientific paper. Cambridge University Press. (Module VI)

Day, R.A. 2000. Scientific English: A guide for Scientists and other Professionals. Universities Press. (Module VI)

Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition : Oxford University Press .

Eldon D. Enger ,Frederick C. Ross and David Bailey 2008 (Eleventh Edition) *Concepts in Biology* .Tata-McGraw Hill , New Delhi.(Module VII, II & III)

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*. Published by Harvard University Press.

Ernst Myer .1997. *This is Biology: The Science of the Living World.* Universities Press, Hyderabad, India

Ervin Schrodinger 1944. What is life? Mind and Matter. Cambridge University Press

Gupta K.C, Bhamrah, H.S and G.S.Sandhu 2006.Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.

Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it. Narosa Publishing House.

Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology.* Vintage Pub. NY

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions*. 3rd ed.: University of Chicago Press, Chicago, ILMarie, M. 2005. Animal Bioethics: Principles and Teaching Methods Wageningen Academic Publishers

Michael Roberts,Tim King and Michael Reiss.1994.Practical Biology for Advance Level. Thomas Nelson and Sons Ltd. Surrey, UK.

Ruxton, G.D. and Colegrave, N. 2006. Experimental design for the life sciences. Oxford University Press.

Sateesh, M.K. 2008 Bioethics and Biosafety; I.K. International Publishing House (Module V)

Taylor D.J. Green N.P.O, Stout G.W. Editor R. S. Oper, 2008 Biological science (Third edition Cambridge University press

23U6PRZOO06:Practical 06

GENERAL INFORMATICS, BIOINFORMATICS, BIOSTATISTICS AND RESEARCH METHODOLOGY

(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Apply MS Word, MS Excel, MS Access principles and to illustrate Internet: access a web page on any biological topic. Frequency distribution, Range and standard deviation and Correlation using any biological data.	PO1 PSO4	A	P	10
CO2	Study a specified sequence from NCBI and search with it in BLAST, download molecular structure data files of DNA, Sugar, Water etc and inspect them through Rasmol and to analyse a specified DNA sequence from NCBI and identify ORF & genes, if any, in it. Download a specified AA sequence from NCBI and plot its hydrophobicity profile.	PO1, PSO4	A	P	8
CO3	Analyse and study at least two samples of genome sequences. Spotters—copies of genome sequences and proteins and Study graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.	PO1, PSO4	A	P	10
CO4	Study Micrometry –calibration and measurement of microscopic objects –low power Paper chromatography.	PO1 PSO4	A	P	4
CO5	Study Instrumentation.	PO1 PSO4	A	P	4

1. MS Word: Mail merge—Preparing mark sheet of students
2. MS Excel: To find mean and median
3. MS Access: To create grading list of students
4. Internet: Access a web page on any biological topic.
5. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
6. Range and standard deviation for a biological data
7. Correlation using any biological data.

8. Download a specified sequence from NCBI and search with it in BLAST and report results with comments.
9. Download molecular structure data files of DNA, Sugar, Water etc and inspect them through Rasmol. .
10. Download a specified DNA sequence from NCBI and identify ORF & genes, if any, in it.
11. Download a specified AA sequence from NCBI and plot its hydrophobicity profile.
    Download and study at least two samples of genome sequences.
12. Spotters—copies of genome sequences and proteins.
13. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.
14. Micrometry –calibration and measurement of microscopic objects –low power
15. Paper chromatography
16. Instrumentation – demonstration (write notes on principle, equipment and its use)
    pH Meter
    Colorimeter/ Spectrophotometer
    Centrifuge
    Electrophoresis

ELECTIVE PAPER : ECOTOURISM AND ECOTOURISM ENTREPRENEURSHIP

Course Code	23U6CRZOO13
Title of the course	Ecotourism and Ecotourism Entrepreneurship
Semester in which the course is to be taught	6
No. of credits	3
No. of contact hours	72

Objectives:

1. To introduce the concepts, principles and applications of tourism and its sustainability
2. To critically analyse the cost and benefits of ecotourism, including related laws and policies, community involvement and future trends
3. To develop an appreciation among students with respect to tourism development from the sustainability perspective
4. To equip the students with basic knowledge for the emerging ecotourism industry
5. To equip the students with basic entrepreneurial skills in ecotourism industry

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Apply the knowledge of tourism concepts along with tourism principles and characteristics	PSO3	A	C	12
CO2	Interpret the diverse nature of ecotourism, concepts and practises with reference to emerging trends	PSO3	An	C	10
CO3	Contextualize eco-tourism with in broader cultural, environmental, dimensions and its impacts	PSO3	Cr	C	10
CO4	Apply the principles of sustainability and eco conservation practices in the tourism industry	PSO3	U, A	C	10
CO5	Create, apply, and evaluate ecotourism entrepreneurship strategies for national development.	PSO3	U, A	C	12

Module I

Fundamentals of Ecotourism (12 Hrs)

Introduction- Tourism, concepts and definitions, Emergence of ecotourism, Principles, Characteristics of ecotourism, The facilitating sectors in ecotourism, Ecotourist, Profiling the ecotourist. Benefits of ecotourism, Quality Assurance in ecotourism.

Module II

Major areas of eco-tourism (10 hrs)

Concepts, practices and case studies for each: Marine tourism Wildlife tourism Adventure tourism, Ecotourism resources in India-National parks, Wildlife sanctuaries Tiger reserve, Wetland and desert

Module III

Emerging trends in eco-tourism (10 Hrs)

Emerging Trends in Ecotourism: Cultural tourism, Pilgrimage tourism, Farm tourism Backwater tourism, Health and medical tourism, Sports tourism

Module IV

Problems and prospects of eco-tourism (10 hrs)

Economics and benefits of ecotourism Cultural issues and negative aspects of ecotourism Environmental Impacts of Tourism

Module V

Sustainable tourism (12 hrs)

Nature and Scope of Sustainable Tourism, Dimensions of Sustainability; Social, Economic, Environmental- Responsible Tourism ,Approaches to Sustainable Tourism, Current practices of eco-conservation in tourism industry

Sustainable Ecotourism Projects - Case Studies on Periyar National Park, Thenmala Eco Project, Sundarbans Ecotourism Project, Kaziranga National Park, Rann of Kutch, Nandadevi

Module VI

Eco-tourism guides (6 hrs)

Ecotourism guiding and case studies

Module VII

Ecotourism Entrepreneurship (12 hrs)

Entrepreneur- meaning, types, qualities, function; Entrepreneurship – characteristics, importance; Role of entrepreneur in national development. Ecotourism Business ideas- sources; Identification of opportunities; Analysis of opportunities. Feasibility – Marketing feasibility and location feasibility Establishing ecotourism enterprise- steps, procedures, license, registration, etc.

References

Bruner, E.M. 2005. *Culture on tour: ethnographies of travel.* The University of Chicago Press.

Ghimire, K.B. and M. Pimbert. 1997. Social change and conservation: environmental politics and impacts of national parks and protected areas. London: Earthscan Publications.

Karan Singh. 1980. Indian Tourism: Aspects of great adventure. Department of tourism. New Delhi.

Ratandeep Sing. 2003. National Ecotourism and Wildlife tourism: Policies and guidelines. Kanishka Publishers, New Delhi

Whelan, T. 1991. Nature tourism: managing for the environment. Washington, D.C.: Island Press.

Brian Garrod and Julie C. Wilson. 2002. Marine Ecosystem. Channel View Publications.

Ratandeep Sing. 2003. National Ecotourism and Wildlife tourism: Policies and guidelines. Kanishka Publishers, New Delh

Vasant Desai, Entrepreneurship Development, Himalaya Pub

Feroze Banker, Progressive Entrepreneur, Kanishka Publications

Mohanty, SangramKeshari (2005). Fundamentals of entrepreneurship, New Delhi.

Gupta &Srinivasan, Entrepreneurial Development

SYLLABI FOR COMPLEMENTARY COURSE (B.Sc. BOTANY PROGRAMME)

ANIMAL DIVERSITY – NON CHORDATA

Course Code	**23U1CPZOO1**
Title of the course	Animal Diversity - Non Chordata
Semester in which the course is to be taught	1
No. of credits	2
No. of contact hours	36

Objectives

1. To acquire knowledge on the taxonomic status of various Invertebrate animals and animal groups.
2. To familiarize the students with the diverse group of organisms around us.
3. To develop an aptitude for understanding nature and its rich bio-diversity.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Distinguish the types of classification and describe Kingdom Protista and its different Phyla	PO1, PO4 PSO1	U	C	8
CO2	Elaborate salient features and taxonomy of Mesozoa and Parazoa and also Phylum Coelenterata and Platyhelminthes	PO1, PO4 PSO1	U	C	7
CO3	Explain the salient features and taxonomy of Phylum Nematoda and Annelida	PO1, PO4 PSO1	U	C	4
CO4	Explain the salient features and taxonomy and to differentiate the Phyla like Arthropoda and Mollusca	PO1, PO4 PSO1	U	C	11
CO5	Explain the salient features and taxonomy of Phylum Echinodermata and Hemichordata	PO1, PO4 PSO1	U	C	6

Module 1

General Introduction (1 hr)

5 Kingdom classification, Classification in general. Introduction to 8 kingdom classification

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications. Zoological Society of Kerala.

Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 2

Kingdom Protista (7 hrs)

Salient features and classification up to phyla

Phylum Rhizopoda: Eg. Amoeba; Phylum Actinopoda: Eg. Actinophrys; Phylum Parabasalia: Eg. Trychonympha; Phylum Metamonada: Eg. Giardia; Phylum Kinetoplasta: Eg. Trypanosoma; Phylum Ciliophora: Eg. Paramecium; Phylum Opalinata: Eg. Opalina; Phylum Sporozoa: Eg. Plasmodium; Phylum Choanoflagellata: Eg. Proterospongia; Phylum Euglenophyta: Eg. Euglena; Phylum Cryptophyta: Eg. Cryptomonas; Phylum Bacillariophyta: Eg. Diatoms; Phylum Chlorophyta: Eg. Volvox; Phylum Dinoflagellata: Eg. Noctiluca; Phylum Microsporidia: Eg. Nosema

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

Pathogenic protista –Plasmodium, Entamoeba.

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala

Module 3

Mesozoa and Parazoa (2 hrs)

Mesozoa – eg. Rhopalura (mention 5 salient features)

Parazoa - Phylum Porifera – eg Leucosolenia

Phylum Placozoa –e g. Trycoplax adherens

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 4

Phylum : Coelenterata (3 hrs)

Salient features, Classification upto classes

1. Hydrozoa – Physalia
2. Scyphozoa – Aurelia

3. Anthozoa – Adamsia

Corals and coral reefs.

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 5

Phylum – Platyhelminthes (2 hrs)

Salient features, classification upto classes

1. Turbellaria – Planaria
2. Trematoda – Fasciola
3. Cestoda – Taenia solium

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 6

Phylum Nematoda (2 hrs)

Salient features, classification upto classes

1. Phasmidia – Wuchereria
2. Aphasmidia – Trichinella

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 7

Phylum – Annelida (2 hrs)

Salient features, classification upto classes

1. Polychaeta, - Nereis
2. Oligochaeta – Earthworm – Pheretima
3. Hirudinomorpha – Hirudinaria

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 8

Phylum Arthropoda (8 hrs)

Salient features

Type - Prawn - Penaeus

Classification upto classes

Subphylum Chelicerata

Class 1. Merostoma – Limulus; 2. Arachinida – Spider; 3. Pycnogonida – Nymphon

Subphylum - Mandibulata

Class 1. Crustacea – Daphnia ; 2. Chilopoda – Centepede; 3. Symphyla - Scutigerella; 4. Diplopoda - Millipede; 5. Pauropoda - Pauropus; Insecta – Butterfly

(Detailed account of examples are not necessary)

Insect pests

1. Pests of coconut – *Oryctes rhinoceros, Rhynchophorus ferrugineus, Nephantis serinopa, Eriophid mite*

2. Pests of paddy – *Leptocorisa acuta, Spodoptera mauritius*

3. Pests of stored grains - *Trogoderma granarium, Tribolium castaneum, Sitophilus oryzae*

Phylum Onychophora – eg. Peripatus (Mention its affinities)

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module: - 9

Phylum – Mollusca (3 hrs)

Salient features, classification upto classes

1. Apalcophora – Neomenia
2. Monoplacophora – Neopalina
3. Bivalvia – Perna
4. Polyplacophora – Chiton
5. Gastropoda – Xancus
6. Cephalopoda – Sepia
7. Scaphopoda – Dentalium

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 10

Phylum – Echinodermata (5 hrs)

Salient features , classification upto classes

Class 1. Asteroidea – Astropecten

2. Ophiuroidea - Ophiothrix
3. Echinoidea – Echinus
4. Holothuroidea – Cucumaria
5. Crinoidea – Antedon

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 11

Phylum Hemichordata (1 hr)

Salient features eg: Balanoglossus

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate Part I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007), Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Selected Further Readings

Barnes, R.D. , 1987. Invertebrate Zoology (W.B. Saunders, New York).

Barrington, E.J.W., 1967. Invertebrate Structure and function (ELBS and Nelson , London).

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

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

Groove, A.J. and Newell, G.E. 1974. Animal Biology – Indian Reprint (University Book Stall, New Delhi).

Hyman, L.H. The Invertebrate vols. (McGraw-Hill) 1942. Comparative vertebrate Anatomy (The University of Chicago Press).

Kapoor, V.C. 1994. Theory and Practice of Animal Taxonomy (Oxford and IBH Publishing Co., New Delhi.)

Kotpal R.L. Agarwal S.K. and R.P. Khetharpal (2002). Modern Text Book of Zoology.

Parker T.J and Haswell W.A. (1962). Text Book of Zoology Vol. I. Invertebrate (ELBS & Macmillan, London).

Marshall, A.J. and Williams, W.D. 1972. Text Book of Zoology Vol. Invertebrates (ELBS and Macmillan, London).

Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi.)

Nair, K.K. Ananthakrishnan, T.N. David, B.V. 1976. General and Applied Entomology (T.M.H. New Delhi).

23U2PCZOO1 : Practicals
ANIMAL DIVERSITY – NON CHORDATA
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Application of scientific principles in drawing invertebrates	PO1 PSO4	A	P	8
CO2	Application of taxonomic principles in identification of invertebrates.	PO1,PO 4 PSO4	A	P	5
CO3	Analyse Prawn Nervous system and Prawn appendages	PO1 PSO4	An	P	6
CO4	Analyse Cockroach Nervous system and mouthparts	PO1 PSO4	An	P	6
CO5	Application of histological principles in invertebrate systematics.	PO1 PSO4	An	P	4

1. Scientific drawing - 5 specimens
2. Simple identification – 25 invertebrates (Out of which 15 by their scientific names)
3. T.S - Earthworm, T.S Fasciola
4. Dissection - Prawn Nervous system
5. Dissection - Cockroach Nervous system
6. Mounting – Prawn Appendages
7. Mounting – Cockroach Mouth parts
8. Virtual dissection of cockroach using 'Virtual Roach'

ANIMAL DIVERSITY – CHORDATA

Course Code	**23U2CPZOO2**
Title of the course	Animal Diversity - Chordata
Semester in which the course is to be taught	2
No. of credits	2
No. of contact hours	36

Objectives

1. To acquire knowledge on the taxonomic status of the various vertebrate animals and animal groups.
2. To familiarise the students with the diverse groups of organisms around us.
3. To develop an aptitude for understanding nature and its rich biodiversity.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Describe the taxonomy of Phylum Chordata, sub phyla Urochordata and Cephalochordata their classes and specific examples.	PO1 PSO1	U	C	5
CO2	Understand the taxonomy and salient features of Sub phylum Vertebrata, divisions Agnatha and Gnathostomata, super class Pisces and its various classes with typical examples and accessory respiratory organs in fish	PO1 PSO1	U	C	5
CO3	Summarize the Class Tetrapoda- Amphibia	PO1 PO4 PSO1	U	C	16
CO4	Explain Class Reptilia and Aves	PO1 PSO1	U	C	7
CO5	Summarize the Class Mammalia and its classification	PO1 and PO4 PSO1	U	C	3

Module I

Phylum Chordata (7 hrs)

General characters of the Phylum Chordata
Classification upto classes
Sub phylum I Urochordata - General characters
Class 1 Larvacea eg . Oikopleura; 2. Ascidiacea eg. Ascidia; 3. Thaliacea eg. Salpa
Subphylum II Cephalochordata - General characters eg. Brachiostoma
Subphylum III Vertebrata - General characters
Division I Agnatha - General characters
Class 1 Cyclostomata eg. Petromyzon
Class 2 Ostracodemi eg. Cephalapis
Division 2 Gnathostomata - General characters
Super class Pisces and Super class Tetrapoda

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala
Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
Young J.Z. 1981. The life of Vertebrate s (Oxford University Press)

Module II

Super class Pisces (3 hrs)

Class 1. Chondrichthyes - eg. Narcine
Class 2. Osteichthyes - eg. Latimeria
Accessory respiratory organs in fishes

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala
Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
Young J.Z. 1981. The life of Vertebrate s (Oxford University Press)

Module III

Super class Tetrapoda (16 hrs)

General characters – Class Amphibia
Type : *Euphlyctis hexadactylus ,* General Characters, Respiratory, Circulatory, Skeletal System & Nervous system
Order I. Urodela eg. Amblystoma; II. Anura eg. Bufo; III Apoda eg. Icthyophis
Account on Paedogenesis and Neoteny

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala
Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
Young J.Z. 1981. The life of Vertebrate s (Oxford University Press)

Module IV

Class Reptilia (4 hrs)

General Characters
Sub class I: Anapsida Eg. Chelone
Sub class II Diapsida Eg. Chameleon
Subclass III Parapsida eg. Icthyosaurus
Poisonous and non-poisonous snakes of India

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala
Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
Young J.Z. 1981. The life of Vertebrate s (Oxford University Press)

Module V

Class Aves (3 hrs)

General Characters
Sub class I : Archeornithes Eg: Archaeopteryx
Sub class II. Neornithes Eg: Struthio
Flight adaptations of birds

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala
Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
Young J.Z. 1981. The life of Vertebrate s (Oxford University Press)

Module VI

Class Mammalia (3 hrs)

General Characters
Sub class I Prototheria eg. Echidna
Sub Class II Metatheria eg. Macropus
Sub class III Eutheria eg. Elephas
Aquatic mammals

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala

Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

Young J.Z. 1981. The life of Vertebrate s (Oxford University Press)

Selected Further Readings

Deoras, P.J. 1981. Snakes of India (National Book Trust of India.)

Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

Groove, A.J. and Newell, G.E. 1974. Animal Biology - Indian Reprint Universal Book Stall, New Delhi.

Induchoodan, 1986, Keralathile Pakshikal (Kerala Sahitya Academy, Trichur).

Kapoor, V.C. 1994, Theory and Practice of Animal Taxonomy (Oxford and IBM Publishing Co. New Delhi.

Lagler, K.F. , Bardach, J.E. , Miller, R.R. Passino, D.R.M. 1977 Ichthyology (John Wiley and Sons).

Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co. New Delhi.

Newman, H.H. 1939. Phylum Chordata, (Macmillan Pub. Co. New York)

Nigam H.C. 1978 , Zoology of Chordata (S. Chand and Co. New Delhi).

Parker, T.J. and Haswell W.A. 1962. Text Book of Zoology Col. II Vertebrates (ELBS and Macmillan , London).

Parter S.H. 1971. The Book of Indian Animals (Bombay Natural History Society).

Salim Ali, 1969. Birds of Kerala (Oxford University Press).

Sinha A.K. , Adhikari S. Ganguly, B.B. 1988. Biology of Animals Vol. II (New Central Book Agency, Calcutta.)

Whitaker, R. 1978 Common Indian Snakes – A field Guide Macmillan and Co. of India Ltd.)

Young J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Young J.Z. Life of mammals) Oxford University Press).

PRACTICALS : 23U2PCZOO1
ANIMAL DIVERSITY – CHORDATA
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Apply taxonomic principles and identify animals belonging to various phyla and classes by their scientific names	PO1 PSO4	U	C	5
CO2	Apply scientific principles and draw vertebrate specimens belonging to different classes	PO1 PSO4	A	P	10
CO3	Analyse the viscera, digestive system, arterial system, sciatic plexus and brain of frog and examine the vertebrae and girdles of frog	PO1 and PO4 PSO4	U	C	5
CO4	Analyze placoid scales in fish.	PO1 PSO4	A	P	5
CO5	Apply taxonomic principles to identify snakes	PO1 and PO4 PSO4	A	P	6

1. Morphology - Scientific drawing – 5 specimens of chordates
2. Simple identification of 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 of placoid scales of shark
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

7. Virtual Dissection: 1. Virtual dissection of Frog:
https://dcc.ilc.org/snc2d/14/the_frog_a_virtual_dissec/the_frog_a_virtual_dissec.html

HUMAN PHYSIOLOGY AND IMMUNOLOGY

Course Code	23U3CPZOO3
Title of the course	Human Physiology and Immunology
Semester in which the course is to be taught	3
No. of credits	3
No. of contact hours	54

Objectives

1. To inspire the students in learning the frontier areas of biological sciences
2. To appreciate the correlation between structure and function of organisms
3. To make them aware of the health related problems, their origin and treatment.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Understand nutrition and deficiency disorders and the the functional aspects of respiration and respiratory disorders, cardiovascular circulation, disorders and clinical aspects	PO1 PSO3	U	C	3
CO2	Analyze the structure and function of human nitrogenous excretory organ and renal disorders.	PO1 PSO3	A	C	6
CO3	Evaluate the structural and functional features of neuromuscular system and its disorders.	PO1 PSO3	E	C	10
CO4	Analyze functional characteristics of hormonal glands and its disorders.	PO1 PSO3	A	C	5
CO5	Analyze the basics of immunology, antigens and antibodies, antigen antibody reactions and its clinical applications as well as the recent trends in immune research.	PO1 PSO3	A	C	13

Part I HUMAN PHYSIOLOGY (36 Hrs)

Module 1

Nutrition (3 hrs)

Malnutrition disorders, Vitamin deficiencies, and mineral deficiencies (Iron, Calcium and Iodine)

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.718-833

Prosser & Brown 2006 : Comparative Animal Physiology

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 2

Respiration (5 hrs)

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

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp432-509

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 3

Circulation (7 hrs)

Blood – Composition and function, Brief account of mechanism of blood clotting; Significance 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 infraction, Angiogram and Angioplasty.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.144-262, 382-429, 711-715.

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 4

Excretion (6 hrs)

Structure of human nephrone, 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, Dialysis

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.264-379

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 5

Neurophysiology (6 hrs)

Structure of typical neuron, myelenated and non myelenated nerve fibres; Nerve impulse – initiation and propagation of nerve impulse, All or none law, Saltatory conduction, Synaptic transmission, Neurotransmitters, Neuromodulators, Brian waves, Electroencephalogram, applications of EEG, Neural disorders – Parkinson's disease, Epilepsy, Alzheimier's syndrome, Dyslexia.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.512-715

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 6

Muscle Physiology (4 hrs)

Striated, Non striated and Cardiac muscle, Ultra structure of striated muscle fibre, Mechanism of muscle contraction, Threshold and spike potential, Fatigue, O_2 dept, Rigor mortis.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.52-86

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 7

Endocrinology (5 hrs)

Endocrine glands and their hormones, mode of action (in brief) , Hypothalamus, Pituitary , Thyroid, Parathyroid, Thymus , Islets of Langerhands, Adrenal, Testis and ovary , Hormonal disorders.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.836-966

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Part II IMMUNOLOGY (18 hrs)

Module 8

Introduction to immunology (3 hrs)

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.

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 1

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 9

Antigen and Antibody (5 hrs)

Antigens: Properties of antigens, Tyoes of antigens (Bases on source of origin, immunogenicity and biology)

Antibodies: Basic structure of immunoglobulins, comparative analysis of different immunoglobulins and its functions.

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 4

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 10

Antigen – Antibody reactions (5 hrs)

Precipitation test, agglutination test ,

Clinical applications of antigen antibody reaction, Widal, VDRL, HIV test (ELISA), Complement Fixation Test, and Coombs test.

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material; Zoological Society of Kerala

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 11

Immune response system (5 hrs)

(Brief accounts of the followings)

Immune response system

Primary and secondary lymphoid organs,

Cells of Immune system – Leucocytes, lymphocytes, T&B cells, Macrophages, Plasma cells , Memory cells, MHC, Antibody synthesis, Monoclonal antibodies, Hybridoma technology

Immune disorders – hypersensitivity, Auto immunity & Immunodeficiency, AIDS,

Vaccines - Major types of vaccines (BCG, DPT, Polio vaccine and TAB vaccines). Recent trends in vaccine preparation.

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala Chapter 10.

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Sobha & Sharma (2008) Essentials of Modern Biology One's Student edition PP 463

Selected Further Readings

Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Colemen: Fundamentals of Immunology

Guyton, Medical Physiology

Ivan Roitt: Essentials of Immunology ELBS.

Madhavankutty, Medical Physiology

Mahupathra, Human Physiology, Current Books

Michael J. Pelczar ECS,Chan& Noel. R. Kreig, Microbiology, Tata McGraw Hill 5th ed. 1996.

Michael J. Gibuay, Ian A. Macdonald and Helen M. Roche, Nutrition and Metabolism.

Monica Cheesbrough: Laboratory Manual for Tropical Countries. Vol.II Microbiology, ELBS – Cambridge Ed. 1986.

Paniker S., Francis G. and Abraham G.K 2008, Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala.

Park, K. Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasidass Bhenot Publications

Prosser and Brown, Comparative Animal Physiology

Sebastian Prof. M.M., Animal Physiology

William S Hoar, Animal Physiology.

23U4PCZOO2 : PRACTICALS
HUMAN PHYSIOLOGY AND IMMUNOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyse human blood cell configuration and Analyse different types of blood groups and Rh factor	PO1 PSO4	An	P	8
CO2	Analyse chemical nature of biological fluids.	PO1 PSO4	An	P	8
CO3	Application of role of salivary amylase on starch	PO1 PSO4	A	P	6
CO4	Analysis of haemoglobin content in human blood.	PO1 PSO4	An	P	6
CO5	Application of Sphygmomanometer and stethoscope.	PO1 PSO4	A	P	4

1. Preparation of Human Blood smear & identification of leucocytes
2. Qualitative analysis of Reducing Sugar, Protein and Lipid
3. Action 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)

APPLIED ZOOLOGY

Course Code	23U4CPZOO4
Title of the course	Applied Zoology
Semester in which the course is to be taught	4
No. of credits	3
No. of contact hours	54

OBJECTIVES

Equip the students interested in the applied branches of zoology with skills and knowledge which can lead to self employment opportunities.

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Application of aquaculture management, aquarium fish management, pearl culture management mussel culture management, and prawn culture management practices for developing entrepreneurial skills.	PSO2	A	P	10
CO2	Application of sericulture management practices for developing entrepreneurial skills.	PSO2	A	P	12
CO3	Application of apiculture management practices for developing entrepreneurial skills.	PSO2	A	P	6
CO4	Application of vermiculture management practices for developing entrepreneurial skills.	PSO2	A	P	12

Module 1:

Aquaculture (24 hrs)

Traditional methods of aquaculture, Advantages and salient features of aquaculture, Types of aquaculture, Biotic and abiotic factors of water, Importance of Alga in aquaculture, Common Cultivable fishes of Kerala Economic importance and morphology of culturable species *Catla,Rohu,Mrigal, Cyprinus carpio,Etroplus,& Tilapia .*

Penaeus indicus,P.monodon,Perna viridis/Perna indicus,Pinctada fucata.

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.

Prawn culture, Mussel culture , Pearl culture

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Module 2

Sericulture (12 hrs)

Four species of silkworms, Life history of silkworms, Silkworm Rearing Techniques. Diseases and Pests of silkworms. Mounting of worms. Harvesting and stiffling of cocoons. Silkworm diseases. Preventive and control measures.

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Module 3

Vermiculture (6 hrs)

Species of Earthworms suitable for vermiculture. Reproduction and Life Cycle . Physical and Chemical effects of Vermiculture, Vermicomposting, Site Selection, Cement pit Soil pit . Preparation of pit. Maintenance and Monitoring

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Venkitaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

Module 4

Apiculture (12 hrs)

Byproducts of honey bees and their uses. Diseases and pests of honey bees, control measures (self-study and assignment)

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Shukla G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Selected Further Readings

Alikunhi, K.h., Fish Cluture in India (ICAR, New Delhi)

Bhosh, C.C., 1949, Silk Production and Weaving in India (CSIR), New Delhi) Director. Zoological Survey of India, 1994, earthworms Resources and Vermiculture

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

Jhingran, V.G., 1985 Fish and Fisheries of India (Hindustan Publ. Corporation, New Delhi)

Kurien, C.V. & Sebastian V.C., Prawn Fisheries in India (Hindustan Publ. Corporation, New Delhi)

Krishnaswami, S., 1986 Improved Method of Rearing Young age Silk worms (Central Silk board Bangalore)

Krishnaswami, S., 1986, New Technology of Silkworm Rearing (Central Silk Board Bangalore)

Lee, K. E., 1985 Earthworms, Their Ecology and relationships with Soils and Land use. Academics Press.

Menon, K.N., 1970 Malsyakrishi (State Institute of language, Trivandrum)

Mysore Silk Association, 1986, Silkworm rearing and Diseases of Silkworms

Padmanabha Aiyer, K.S., 1992, Records of the Indian Museum Vol. XXXI, Part I, PP. 13-76 An Account of the Oligochacta of the Travancore

Shiggene, K., 1969, Problems in Prawn Culture (American publ. Co., New Delhi)

Shukla G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Andhra Pradesh Agricultural University, Hydrabad)

Sinhan, V.R.P. & Ramachandran, V., 1985, Fresh water Fish Culture (ICAR, New Delhi)

Singh, S., 1962 Bee keeping in India (ICAR, New Delhi)

Singh, V.P.P. and Ramachandran, V., 1985 Freshwater Fish Culture (ICAR, New Delhi)

Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Ullal, S. R. and Narasimahanna, M.N., Handbook of Practical Sericulture (Central Silk Board Bombay.)

Venkitaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

PRACTICALS : 23U4PCZOO2
APPLIED ZOOLOGY
(36 hrs)

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Analyse, identify and examine the culturable species of fishes, culturable species of earthworms, castes of honey bees and silkworm	PO1, PO4 PSO4	A	P	6
CO2	Analyse the bee keeping equipments and chandrike and develop entrepreneurial skills	PO1, PO4 PSO4	E	P	6
CO3	Examine the products and by-products of apiculture, sericulture and vermicomposting	PO1 PSO4	E	P	6
CO4	Analyse and study the different types of fish diseases and fish parasites	PO1, PO4 PSO4	E	P	6

1. General Identification, Economic importance, Morphology, scientific names and common names of the following
   a. Economic importance and morphology of culturable species - (Catla, Rohu, Mrigal ,Grass carp, Common carp, , Etroplus,Tilapia, *Penaeus indicus,/P.monodon, Perna viridis/P.indicus,Pinctada fucata)*
   b. 2 species of earthworms used in Vermiculture
   c. Two species of honey bees
   d. Silkworm. Cocoon/Adult
2. 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 2diagrams/specimens)
7. Fish Parasite (any one)

SYLLABUS OF ZOOLOGY OPEN COURSE FOR OTHER STREAMS

HUMAN GENETICS, NUTRITION, COMMUNITY HEALTH AND SANITATION

Course Code	**23U5OCZOO1**
Title of the course	Human Genetics, Nutrition, Community Health and Sanitation
Semester in which the course is to be taught	5
No. of credits	3
No. of contact hours	72

Objectives of the Course

1. To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.
2. To emphasize the central role that biological sciences plays in the life of all organisms.
3. To introduce the student to some of the present and future applications of bio-sciences

CO	CO Statement	POs/PSOs	CL	KC	Class sessions
CO1	Appreciate the basic principles of human genetics, the disorders associated with it	PO1 PSO3	U	C	9
CO2	Examine the genetic principle of blood group inheritance, sex determination, DNA fingerprinting	PO5 PSO3	U	C	9
CO3	Become aware of the importance of healthy diet and the diseases associated with it	PO5 PSO3	U	C	18
CO4	Analyse the mode of transmission of different diseases and their preventive measures	PO1 PSO3	U	C	18
CO5	Appreciate the role of society in promoting community health	PO5 PSO3	U	C	18

PART I HUMAN GENETICS (18 hrs)

Module I

Chromosomal and gene disorders (9 hrs)

Concept of gene, DNA, chromosome, normal chromosome complement, karyotype. Genetic disorders in man- single gene disorder- colour blindness, poygene disorder- cleftlip and palate. Chromosomal anomalies. Eg. Down Syndrome and Cridu chat syndrome. Sex chromosomal anomalies –Klinefelter Syndrome and Turner Syndrome. Pre– natal Diagnosis (Amniocentesis, Chorionic Villus Sampling, Ultra sound scanning)

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell biology Genetics & Biotechnology published by Zoological Society of Kerala.

Module II

Blood typing, DNA finger printing and Human reproduction (9 hrs)

Human blood groups and their inheritance pattern, Rh factor, Blood transfusion, Importance of Blood donation- Universal Donor, Universal recipient.

DNA finger printing and applications – Probing for criminals – Method to resolve paternity and maternity disputes.

Causes of human infertility – a brief account. Human genome project – a brief account.

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell biology Genetics & Biotechnology published by Zoological Society of Kerala.

PART – II NUTRITION (18 hrs)

Module III

Health and Nutrition (6 hrs)

Definition and Meaning of Health, Dimensions and Determination of Health

Concept of Food and Nutrition, Food Stuffs – Carbohydrates, Proteins, Lipids - their sources and importance.

Vitamins - their sources and importance, Deficiency Disease

Minerals – their role in body functions, resources

Importance of water and roughage in diet

Concept of Balanced diet, Malnutrition and associated problems

Determination of Caloric intake and expenditure, Body Mass Index (BMI) and its importance

Core Readings

K Park, (2008) Park's Text Book of Preventive and Social Medicine 18th Edition. Banarasidass Bhenot Publication.

Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book.

Module IV

Lifestyle Diseases (12 hrs)

Lifestyle diseases - Obesity, causes and preventing measures, Diabetes, Cardiovascular disorders - Prevention and Management. Blood pressure, cholesterol, Transient Ischemic Attack (TIA), Stroke (Symptoms and treatment), Cardiac ischemia (Heart attack), ECG, Angiogram, Angioplasty; Cancer-causes of cancer, carcinogens, diet & cancer; AIDS – causes & preventive measures,

Core Readings

Norman Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi

Fashey , Tomas D, Insel , Paul M and Roth Walt (2005) Fit and Well. New York; Mc Graw Hill Inc

Rai. B.C. Health Education and Hygiene. Published by Prakashan Kendra, Lucknow

PART III COMMUNITY HEALTH AND SANITATION (36 hrs)

Module V

Introduction (10 hrs)

Public health and water quality. Prevention of Water borne diseases. Faecal bacteriae and pathogenic microorganisms transmitted by water. Cholera and Typhoid.

Core Readings

Pelczar M.J. Jr. E.C.S. Chane& N.R. Krieg, Microbiology (Concept & Applications). 5th edition. Tata McGraw Publishing Company Ltd.

Module VI

Food borne diseases and their prevention (10 hrs)

Food poisoning caused by toxins produced by microbes eg Staphylococcal food poisoning, Botulism, Salmonellosis

Core Readings

Pelczar M.J. Jr. E.C.S. Chane& N.R. Krieg, Microbiology (Concept & Applications). 5th edition. Tata McGraw Publishing Company Ltd.

Panicker S, Franis G And Abraham g. (2008) Microbiology & Immunology. Zoological Society Study Material Series. Published by Zoological Society of Kerala.

Module VII

Endemic, Epidemic and Emerging diseases (12 hrs)

Endemic, epidemic, pandemic diseases- outbreak- Emerging diseases – Dengue, bird flu (H5N1), Reemerging diseases – TB- Vector borne diseases (mosquito) and their control measures (Chikungunya and Dengu fever)- Leptospirosis and preventive measures – Rodent control measures

Module VIII

Community Health Promotion (4 hrs)

Definition of community Health, Importance of community Health, Programs on Community health promotion (Individual, Family and Society), Dangers of alcoholism and drug abuse, medico-legal implications.

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell biology Genetics & Biotechnology published by Zoological Society of Kerala.

SYLLABI FOR EXTRA-CREDIT COURSES

CERTIFICATE COURSE IN FAUNAL IDENTIFICATION

The present course is specifically designed for the students studying Zoology at UG level as per the UGC approved curriculum. This course is a mandatory Extra Credit course for all UG students from I year onwards.

Course Design

This is a 2-credit course distributed over 2 years. The student shall complete 1 credit in a year. The course-wise distribution of the credits is as follows:

S. No	Type of course	No. of credits	No. of Hours
1	Faunal Diversity - Invertebrates	1	18
2	Faunal Diversity - Vertebrates	1	18
	Total	2	36

The course will cover the essential aspects of Identification and Documentation, Taxonomic position and classification, Identification, behaviour, feeding and other relevant topics. Seminars and classes on topics of modern-day concern will be included. Experiential learning through nature trail, Guided Nature Walks, Seminars, Talks and Experience Sharing shall be the mode of transaction.

23UECZOO01: EXTRA CREDIT COURSE 1
FAUNAL DIVERSITY – INVERTEBRATES
(18 hrs)

Objectives of the course

1. Exploration, Survey, Inventorying and Monitoring of invertebrate faunal diversity
2. Documentation of invertebrate faunal biodiversity of Ernakulam urban region.
3. Parataxonomy of all invertebrate faunal components collected.

Syllabus

Introduction, identification and classification of invertebrates; Biodiversity hotspots in India and FAQs; Invertebrate diversity in Western Ghats; Importance, threats and conservation of Invertebrates; Online resources for identification of fauna

References

Gupta, I.J. and Mridula Majumdar, 2012. Handbook on Diversity in some of the Indian Butterflies (INSECfA: LEPIDOfYfERA) : 1-310. (Published by the Director, 2001. Surv. India, Kolkata).

Dhamorikar, Aniruddha; Gore, Kedar. (2015). Some Insects and Spiders of Kanha Tiger Reserve. The Corbett Foundation.

Ttiwilli, S., T. Karmakar, K. Isvaran, and K. Kunte. 2022. Habitat preference and functional traits influence responses of tropical butterflies to varied habitat disturbance. *International Journal of Tropical Insect Science*, 42:855–864.

Joshi, S., R. Gassah & V. A. Ismavel. 2021. Dragonflies and damselflies (Insecta: Odonata) of Karimganj District, Assam, India with four additions to the Indian checklist. *Oriental Insects*, published online ahead of print.

Sebastian, P. A. & Peter, K. V. (2009). *Spiders of India*. Universities Press, Hyderabad, 614 pp.

Joshi, S., J. Veino, D. Veino, L. Veino, R. Veino, and K. Kunte. 2017. Additions to the Indian dragonfly fauna, and new records of two enigmatic damselflies (Insecta: Odonata) from northeastern India. *Journal of Threatened Taxa*, 9:10433–10444. PDF file (14 MB, has colour figures, and first descriptions).

Price, B. W., E. L. Allan, K. Marathe, V. Sarkar, C. Simon, and K. Kunte. 2016. The cicadas (Hemiptera: Cicadidae) of India, Bangladesh, Bhutan, Myanmar, Nepal and Sri Lanka: an annotated provisional catalogue, regional checklist and bibliography. *Biodiversity Data Journal*, 4:e8051. PDF file (1.3 MB).

Kunte, K., S. Sondhi, and P. Roy (eds.). 2020. *Butterflies of India*. v. 2.86. Indian Foundation for Butterflies. URL: https://www.ifoundbutterflies.org/.

23UECZOO02: EXTRA CREDIT COURSE 2
FAUNAL DIVERSITY – VERTEBRATES
(18 hrs)

Objectives of the course

1. Exploration, Survey, Inventorying and Monitoring of vertebrate faunal diversity
2. Documentation of vertebrate faunal biodiversity of Ernakulam urban region.
3. GIS and Remote Sensing studies for animal diversity

Syllabus

Vertebrate Species and Habitats; Faunal Population Estimation; Remote Sensing and GIS; Wildlife Management (Human Wildlife Conflict including Capture and Restraint, Ex-Situ Conservation and management, Communities and Outreach).

References

Bijukumar, A and Raghavan, R. 2015. A checklist of fishes of Kerala, Indis. Journal of Threatened Taxa. 7,13 (Nov 2015), 8036-8080.

Ali, Sálim, 1896-1987. Birds of Kerala. [Madras] Oxford University Press, 1969 (OCoLC)712602528

Praveen, J. & P.O. Nameer. 2021. An atlas of the birds of Kerala. Kerala Agricultural University and Bird Count India. Kerala. 219 p.

P S Sivaprasad, 2013, Common Amphibians of Kerala (Frogs and Toads), Kerala Sate Biodiversity Board.

Palot, M.J. (2015). A checklist of reptiles of Kerala, India. *Journal of Threatened Taxa* 7(13): 8010–8022; http://dx.doi.org/10.11609/JoTT.2002.7.13.8010-8022

Easa, P.S & K.K. Ramachandran (2004). *Biodiversity Documentation for Kerala. Part 10: Reptiles*. Kerala Forest Research Institute, Peechi.

Nameer, P. O. (2015). "A checklist of mammals of Kerala, India". *Journal of Threatened Taxa*. 7 (13): 7971–7982. doi:10.11609/JoTT.2000.7.13.7971-7982

Nameer, P. O. (2016). "Checklist of Marine Mammals of Kerala". *Journal of Threatened Taxa*. 8 (1): 8417–8420. doi:10.11609/jott.2497.8.1.8417-8420

MODEL QUESTION PAPERS

B. Sc DEGREE END SEMESTER EXAMINATION SEMESTER 1 : ZOOLOGY (CORE COURSE)
COURSE : 23U1CRZOO1 : ANIMAL DIVERSITY NON-CHORDATA - 1

Time : Three Hours Max. Marks: 60

PART A Answer All (1 mark each)

1. Which type of animals are studied in Arachnology?
2. The type of symmetry found in the protistan Volvox is
3. Define systamatics
4. Define metagenesis
5. What does mean by lasso cells?
6. What is mushroom coral? Give its scientific name
7. What are glass sponges?
8. Give any two unique features of Comb jellies

(1 x 8 = 8)

PART B Answer any 6 (2 marks each)

9. How experiments are important in science?
10. What is meant by bilateral symmetry? Give an example
11. What is syngamy?
12. Comment on the ecological significance of Diatoms.
13. How ctenophores are advanced than cnidarians?
14. How the jet propulsion method work in Obelia?
15. How do you differentiate corals from coral reefs?
16. How cnidoblasts are different from statocyst?

(2 x 6 = 12)

PART C Answer any 4 (4 marks each)

17. Write a description of different types of body symmetry with examples for each type.
18. Write notes on the classification system used by Aristotle.
19. How the ciliary movement help locomotion in Paramecium?
20. Describe the structure of seagooseberry using neat illustrations. Mention its ecological significance
21. Evaluate how the mechanism of endomixis is done in Paramecium ? Add notes on its significance
22. What are coral reefs? Mention the economic importance (4 x 4 = 16)

PART D Answer any 2 (12 marks each)

23. Describe features of each kingdom as recognized in the five kingdom classification.
24. Elucidate the anatomy of Paramecium using Illustration. Mention the significance of macronucleus.
25. Discuss the structure and mechanism of metagenesis of an Obelia colony. Use neat sketches
26. How Coelentrates are classified ? Explaiin the defining features and structure using an example

(12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 2 : ZOOLOGY COURSE : 23U2CRZOO02 : ANIMAL DIVERSITY NON - CHORDATA II

Time : Three Hours Max. Marks: 60

PART A Answer All (1 mark each)

1. What is strobila ?
2. Name the scientific & common name of a soil transmitted trematode
3. Specify the role of setae in Pheretima
4. Give the term which describes the development of an animal through larval stages to adult.
5. Give the scientific name of a cave velvet worm.
6. Give the scientific name of pearl oyster
7. What is known as sieve plate?
8. Which phylum is sometimes called stomochordata? Why? (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Identify the sensory organs in thread worms
10. Explain turtle leeches
11. What is known as parthenogenesis?
12. What is known as moulting?
13. Reflect on the significance of mantle cavity in molluscs
14. Reflect the working of respirstory trees
15. What is the peculiarity of the development of Hemichordates?
16. Explain Arthropodan afinities of Peripatus (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Point out the salient features of group trematodes. Write on any two parasites on the group
18. What is body segmentation ? How it is significant in Pheretima posthuma ?
19. List out different vector arthropods and give the names of diseases and their preventive measures.
20. Describe thoracic appendages in prawn
21. Describe the salient features of Phylum Mollusca. Give a scheme of classification up to classes
22. Elaborate the following using diagrams
    a) Pedicelaria b) Aristole's Lantern c) Respiratory trees (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. Present the Nervous system and it's working in Pheretima posthuma. Add note on regeneration capacity in the species
24. Describe the salient features and classification of Phylum Arthropoda.
25 Explain salient features of Echinodermata and write a note on the different classes
26. Elucidate the basic morphology and mechanism of water vascular system in echinoderms. Add notes on the system in sea lilies (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 3 : ZOOLOGY

COURSE : 23U3CRZOO3 : ANIMAL DIVERSITY – CHORDATA

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. Which of the below given character is absent in Agnatha?
   a) Tail b) Caudal fin c) Lower jaw d) Nerve chord
2. Name the chordate subphylum in which the notochord extends forward beyond the level of mouth
3. What is the specific name of the larva of lampreys?
4. Give the genus name of any one elasmobranch fish.
5. What do you mean by a poikilotherm?
6. How many pairs of cranial nerves do reptiles have?
7. Give the mode of feeding in Echidna and its adaptive features.
8. What is fenestra ovalis? (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. What is Notochord?
10. What is the function of Atrium in Amphioxus?
11. What is known as velum?
12. What are the salient features of animals that belong to the class Ostracodermi?
13. Classify the class Amphibia into orders.
14. Enumerate the salient features of subclass anapsida
15. Write the salient features of Order Primata.
16. Write a short note on the ventricles of the brain in Rabbit. (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Describe the salient features of class Ascidiacea by illustrating the organization of the body of an example animal
18. What are the salient features of Superclass Pisces?
19. Discuss the salient features of Chondrostei with an illustration of the body features of an example.
20. Describe the major morphological volant adaptations of birds
21. Compare the identification tools for poisonous and non-poisonous snakes
22. Describe the digestive glands in rabbit (4 x 4 =16)

PART D

Answer any 2 (12 marks each)

23. Illustrate the body organization of Amphioxus. Use neat diagrams
24. Discuss the common culture fishes of Kerala
25. Define Dentition. Write an essay on Dentition in mammals with suitable examples.
26. Write an essay on the sense organs of Rabbit (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 4 : ZOOLOGY

COURSE : 23U4CRZOO04 : APPLIED ZOOLOGY

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. Scientific name of Green Mussel
2. Name a carp species that can be cultivated in sewage treatment ponds.
3. What is a cocoonage?
4. What is cocoonase?
5. Give the scientific name of the 'Indian blue'.
6. Which group in bee hive are produced from parthenogenetically formed eggs?
7. Who coined the name Rhode Island red?
8. Give the uses of a biogas plant. (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Explain the cause and symptoms of Epizootic Ulcerative Syndrome in fishes
10. What is monosex culture?
11. Write a note on Chandrike.
12. Write a note on the pupa of mulberry silkworm.
13. Earthworms are called the friends of the farmer. Why?
14. What is propolis?
15. What is a brood chamber ?
16. What are the advantages of a biogas plant? (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Briefly discuss the various processes under pond management
18. Explain the recognizing features of fishes used for Aquaculture in Kerala.
19. Explain the processing of cocoons.
20. Write a brief on Indian bee.
21. Discuss the major economic uses of bee products?
22. Write a short note on Rhode Island Red chicken breed (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. Examine the importance of various physical and chemical factors in aquaculture ponds.
24. Elaborate on the life cycle of mulberry sillkworm with a neat diagram.
25. Elaborate on site selection for setting up of a vermicomposting unit.
26. Elaborate on the modern types of bee hives used in apiary management. (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER – 5: ZOOLOGY (CORE COURSE)

COURSE:23U5CRZOO05: CELL BIOLOGY AND MOLECULAR BIOLOGY

Time: Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. What are Junk genes?
2. Give two functions of cytoskeleton.
3. What is G1 phase?
4. What are Balbiani rings?
5. Define Cell theory.
6. What are transposons?
7. Give two characteristics of genetic code.
8. What is cell coat? (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Distinguish between heterochromatin and euchromatin.
10. What is paracrine signaling?
11. What are PPLO?
12. Define GERL concept.
13. What are the roles of vitamins in cell signaling?
14. What are split genes?
15. What do you mean by cell recognition?
16. Draw a diagram of mitochondria and label its parts. (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Write an account on the types of RNA. Discuss their functions.
18. Explain Polytene chromosomes.
19. Explain Fluid mosaic model with diagram.
20. Briefly explain the different models of plasma membrane?
21. Explain Griffith's transformation experiments?
22. Give an account on methods of cell signaling. (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. Give an account on the post transcriptional and translational modifications in prokaryotes.
24. Distinguish between mitosis and meiosis and give illustrations.
25. Briefly explain different types of membrane transport?
26. Explain the structure and function of Golgi apparatus. (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 5 : ZOOLOGY

COURSE : 23U5CRZOO06 : ENVIRONMENTAL BIOLOGY

Time : Three Hours Max. Marks: 60

PART A Answer All (1 mark each)

1. Who defined ecology as "the study of the organisms in relation to their environment"?
2. What is meant by the term 'oligotropic lake'?
3. What are neuston?
4. What is known as 'rainforests of the sea'?
5. Name the scientist who used the term 'Niche', for the first time in ecology?
6. What is nuclear pollution?
7. What is the unit used to describe the thicknesses of Ozone layer?
8. Expand LDPE

(1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Differentiate between Autecology and Synecology
10. Enumerate the adaptations of animals living in the forest biome
11. What is meant by biotic potential of a population?
12. State the goals of Red List as per IUCN
13. Differentiate between renewable and non-renewable resources
14. Discuss the effects of noise pollution
15. What is meant by global warming?
16. Discuss the problems of plastic pollution in seas and oceans

(2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Discuss the importance of Groundwater
18. Discuss the term 'Keystone species' with suitable examples. Mention their importance
19. Differentiate the three types of species diversity citing suitable examples
20. Elaborate on energy conservation
21. Give an account of marine pollution
22. Write a note on flows

(4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. What are the causes and consequences of landscape changes? Elaborate the current situation in Kerala
24. Discuss the different types of conventional energy sources and present an account of their disadvantages
25. Elaborate on the challenges caused by global warming
26. Give an account of floods with a note on their types, effects and mitigation measures

(12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION
SEMESTER –5: ZOOLOGY (CORE COURSE)
COURSE: 23U5CRZOO07: EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY

Time: Three Hours Max. Marks: 60

PART A Answer All (1 mark each)

1. Special Creation Theory
2. Pangenes
3. Genetic Drift
4. Explain Discontinues distribution with an example
5. Two examples of continental islands
6. Mention the Golden age of reptiles
7. Name the Pleistocene horse
8. Imprinting (1 x 8 = 8)

PART B
Answer any 6 (2 marks each)

9. Write notes on coacervation and coacervates
10. Explain microevolution
11. What is radiocarbon dating
12. Write notes on Use and Disuse theory
13. What are the features of Miohippus?
14. Differentiate between transition and transversion
15. Comment on punctuated equilibrium
16. Differentiate between phyletic speciation and true speciation (2 x 6 = 12)

PART C
Answer any 4 (4 marks each)

17. Briefly explain the Hardey-Weinberg equillubrium and factors affecting gene frequencies
18. Describe Urey - Miller experiment
19. Briefly explain supplementary theories of Darwin
20. Write notes on Human Pheromones
21. Briefly explain Oriental realm
22. Comment on any four learning behaviors (4 x 4 = 16)

PART D
Answer any 2 (12 marks each)

23. Describe in detail Darwin's theory of Natural Selection and Modern synthetic theory
24. Write an essay on adaptive radiation with special reference to mammals.
25. Write in detail about Kinds and Means of Animal Distribution
26. Write an essay on Biogeography of India with special reference to Western Ghats

(12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 5 : ZOOLOGY

COURSE : 23U5CRZOO08 : BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

Time : Three Hours Max. Marks: 60

PART A

Answer All the following (1 mark each)

1. Which neuroglia are responsible for forming the myelin sheath around axons in the peripheral nervous system ?
2. Define fast and slow muscle
3. What is the product of hydrolysis of proteins?
4. Give the site of ETC.
5. What is osmotrophy?
6. What is acidosis ?
7. Name the factor VIII in blood coagulation .
8. What is PCT and DCT in kidney structure ? (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Define electrical and chemical synapse.
10. Why is the refractory period important for a neuron?
11. Which are the chemical classifications of hormones ?
12. Define simple lipid with example.
13. Differentiate competitive and non-competitive inhibition in enzyme action.
14. What is an ulcer ?
15. Which are the steps in the process of respiration ?
16. Substantiate the term ‘universal donor’ (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Write about the adrenal gland and its disorders.
18. Which are the sources of energy for muscle contraction ?
19. Illustrate with examples the classification of carbohydrates.
20. Explain the different reactions involved in protein metabolism with examples.
21. Brief on the theories of mechanism of enzyme action.
22. Elaborate on nutrition during lactation (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. Elaborate on the major disorders and malfunctions of gastrointestinal tract .
24. Elaborate on the process of haemostasis .
25. Elaborate on the process of urine formation. Explain how counter current mechanism helps in the process .
26. Write an essay on EEG. (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 6 : ZOOLOGY

COURSE :23U6CRZOO09: REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. Describe Natural markings of Fate map?
2. What is ejaculation?
3. Define corpus leutum
4. Describe the cleavage in Drosophila.
5. What is subgerminal cavity in chick embryo?
6. Define CRS
7. Comment on the germ layer theory
8. Point out any two differences between sperm and ovum (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. What are the characteristic features of Endotheliochorial placenta?
10. What is the difference between Hunchback and Caudal genes?
11. Illustrate a chick embryo that has been in the incubator for 33 hours.
12. What is Cytomegalo virus?
13. Analyze the significance of middle piece in the structure of human sperm
14. Differentiate between facultative and obligate parthenogenesis
15. Explain the biological impact of abortion
16. Categorize the type of metamorphosis in house fly. (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Describe Emboly and its types?
18. Write a brief description of zygotic genes.
19. What is the importance of a chick embryo that has been in the incubator for 24 hours?
20. Write a brief note on frog gastrulation.
21. Analyze the scope and carriers in embryology. Mention the significance of the embryology
22. Elucidate the mechanism of limb regeneration in Amphibians (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. What is the menstrual cycle and what are the phases of it?
24. Describe the development of a frog's eye.
25. Prepare a detailed essay on the classification of eggs. Use neat illustrations
26. Discuss the significance of gray crescent region providing the experimental evidences of Spemann (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 6: ZOOLOGY

COURSE: 23U6CRZOO10: GENETICS AND BIOTECHNOLOGY

Time: Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. Define biotechnology
2. Define rDNA technology.
3. Define a gene
4. State factor hypothesis
5. Present your idea on linked genes with the help of a diagram
6. Why bar body is named so?
7. Define bacteriophages
8. Name the basic components of a bacterial transposon. (1 x 8 =8)

PART B

Answer any 6 (2 marks each)

9. Differentiate between cloning vectors and expression vectors.
10. Restriction endonucleases are called molecular knives. Justify.
11. Differentiate the terms dominance and epistasis
12. The environment has got a role in sex determination. Examine with examples
13. Analyze the role of STOP codon in a mutation
14. Illustrate the different pedigree symbols used for a pedigree chart.
15. What is epistasis? Give suitable examples?
16. Write a note on Kappa particles in Paramecium. (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Explain the steps in the construction of a gene library
18. Explain PCR
19. Blood group system in man is a multiple allele condition. Examine the statement.
20. Discuss on the impact of location change of chromosomes in an organism
21. Outline the different patterns of single-gene disorders. Exemplify sickle cell anemia as an autosomal recessive inheritance
22. Expand PAR. Consider Xeroderma pigmentosum as a disorder to show incomplete sex linkage (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. Elaborate on Blotting techniques.
24. Explain stem cells, its various types and its potential applications.
25. Discuss the system of sex determination in Drosophila. Add notes on the occurrence of gynandromorphs
26. Outline the autosomal anomalies of the chromosomal aberrations. (2 x 12 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2022

SEMESTER 6 : ZOOLOGY

COURSE : 23U6CRZOO11: MICROBIOLOGY AND IMMUNOLOGY

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. Comment on the role of Edward Jenner.
2. Give the scientific name of baker's yeast.
3. What are capsomeres?
4. Define epidemic disease.
5. Define immunity.
6. Who developed immunization against rabies?
7. What is a hapten?
8. What is HSC? (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Define sterilization taking two agents as example.
10. Comment on enriched media.
11. List out the environmental factors affecting bacterial growth.
12. Differentiate endogenous and exogenous infections.
13. What are the symptoms of TB?
14. Comment on dermatophytosis.
15. Differentiate primary and secondary lymphoid organs giving examples.
16. Comment on AIDS. (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. Briefly explain the physical methods of sterilization.
18. Brief on the different techniques used for microbial culture preservation.
19. Brief on the pathogen, symptoms and prophylaxis of influenza.
20. Comment on BCG, DPT, TAB and OPV.
21. Briefly explain the role played by different cells of immune system.
22. Briefly explain autoimmune disorders and their causes taking one example. (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. With the help of a diagram explain the bacterial anatomy
24. Elaborate on the structure of animal viruses and bacteriophage with the help of suitable diagrams.
25. Define immunity. Give its classification. Add a brief note on each type.
26. With the help of a diagram explain the basic structure of antibody. Also add a note on the different classes of immunoglobulins. (2 x 12 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 6 : ZOOLOGY

COURSE : 23U6CRZOO12: GENERAL INFORMATICS, BIOINFORMATICS, BIOSTATISTICS AND RESEARCH METHODOLOGY

Time : Three Hours Max. Marks: 60

PART A: Answer All (1 mark each)

1. What is Flash ROM?
2. Enlist any four features of a computer
3. What is the importance of databases?
4. Explain plain sequence format
5. What is EMBL stands for?
6. What is Molecular Phylogeny?
7. Name a hydrophobicity scale?
8. What is a frequency polygon? (1 x 8 = 8)

PART B: Answer any 6 (2 marks each)

9. Explain FASTA sequence format
10. What is the use of bioinformatics in drug discovery? Explain CADD
11. Explain what is Molecular Simulation?
12. What is the difference between primary and secondary data?
13. What is regression? What are the different types?
14. What are the uses of a colorimeter?
15. Explain the advantages of PAGE?
16. Explain the IMRAD format of research reporting (2 x 6 = 12)

PART C: Answer any 4 (4 marks each)

17. Explain the terms associated with molecular phylogeny?
18. Discuss the applications of Rasmol, BLAST and Protscale.
19. Find quartile deviation.
    1120,1240,1320,1040,1080,1200,1440,1360,1680,1730,1785,1342,1960,1880,1755,1720, 1600,1470,1750,1885.
20. Discuss the working of a phase contrast microscope
21. Explain the optical parts of a compound light microscope
22. Explain the terms seminar, debate, workshop and conference (4 x 4 = 16)

PART D: Answer any 2 (12 marks each)

23. What is correlation? What are the different types of correlation?
24. Find standard deviation

Size of item	6	7	8	9	10	11	12
Frequency	3	6	9	13	8	5	4

25. Elaborate on the working of different types of light microscopes
26. Explain the procedure and format of application for a funded research project

(12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2022

SEMESTER 6 : ZOOLOGY

COURSE : 23U6CRZOO13: ECOTOURISM AND ECOTOURISM ENTREPRENEURSHIP (EL)

Time : Three Hours Max. Marks: 75

PART A Answer All (1 mark each)

1. Analyse the functions of Ecotourism?
2. Illustrate the principle of ecotourism?
3. Comment about Surfing
4. Differentiate Kayaking from Canoeing?
5. Define community based ecotourism ?
6. Define health tourism?
7. Define naturalist
8. Entrepreneurs are job creators, as opposed to job seekers. Explain
9. Define feasibility analysis
10. Health tourism is a growing ecotourism industry. Justify. (1 x 10 = 10)

PART B

Answer any 8 (2 marks each)

11. Give an account of soft adventure ?
12. Analyze the facilitating sector in tourism?
13. Analyze how ecotourism is valuable for people and the Planet?
14. Evaluate the different subsets of nature tourism
15. Comment about India's Two Most Sustainable destination centres?
16. Explain the Principles of sustainable tourism?
17. Differentiate between a naturalist and scientist
18. Justify the selection of 'computer knowledge' as an essential skill of an entrepreneur
19. Write the impact of pollution as a result of ecotourism?
20. What are the benefits of cultural ecotourism? (2 x 8 = 16)

PART C

Answer any 5 (5 marks each)

21. Enumerate the characteristics of tourism
22. Describe the major attractions, activities and events of marine tourism
23. Summarize the duties of Eco-development committees?
24. Discuss the role of an ecotourism guide in ecotourism industry
25. Discuss the role of entrepreneur in national development
26. Culture of a region is modified by ecotourism. Explain.
27. How does the study of ecotourism benefit India? (5 x 5 = 25)

PART D

Answer any 2 (12 marks each)

28. Create a five days ecotourism plan which promotes nature tourism, and heritage tourism ?
29. Discuss the ecotourism business plan outline
30. Elaborate on the positive and negative impacts of ecotourism.
31. Backwater tourism is the backbone of tourism in Kerala. Justify this in the light of ecotourism (12 x 2 = 24)

UNDERGRADUATE END SEMESTER EXAMINATION
SEMESTER 5 : ZOOLOGY (OPEN COURSE)
COURSE :2319U5OCZOO1 : HUMAN GENETICS, NUTRITION, COMMUNITY HEALTH AND SANITATION

Time : Three Hours Max. Marks: 75

PART A: Answer All (1 mark each)

1. Remember any two zoonotic diseases
2. Expand SARS
3. Why Aids is Known as a syndrome?
4. Describe the Global Recommendations of physical activity of adults aged18-64 years?
5. Comment about the minerals
6. Expand the MPN in water quality
7. Expand ORS
8. Name one numerical chromosomal anomaly.
9. Name the discoverer of A, B, O blood group
10. Which blood group is said to be universal donor? (1 x 10 = 10)

PART B

Answer any 8 (2 marks each)

11. Differentiate Latent and Active TB
12. Explain epidemic disease with an example
13. What do you mean by heart failure?
14. Comment about the measures of home safety
15. What are deficiency diseases? List a few.
16. Describe the benefits and importance of physical education?
17. Discuss the Primary treatment of waste?
18. Name two sex chromosomal anomalies
19. List out four applications of DNA fingerprinting
20. Name the antigen and antibody present in person with blood group AB (2 x 8 = 16)

PART C

Answer any 5 (5 marks each)

21. What is H1N1 influenza? Discuss on the prevention and treatment of the disease
22. Elucidate the mechanism of formation of diabetes in human body. Add notes on its symptoms.
23. Explain sprain, abrasion and fracture.
24. Comment about the Lifestyle diseases. Write a short note on Prevention and Management?
25. Write an account about food borne diseases?
26. Briefly explain the sex chromosomal anomalies.
27. Brief on the principle and applications of DNA fingerprinting (5 x 5 = 25)

PART D

Answer any 2 (12 marks each)

28. Explain infertility and its causes in males and females.
29. Comment on prenatal diagnosis and its significance. Briefly explain the techniques commonly used in prenatal screening.
30. Explain ABO and Rh blood group system. Add a note on blood transfusion
31. Elucidate the structural changes in cancer cells. Add notes on the development of cancer

(12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION

SEMESTER 1 : COMPLEMENTARY ZOOLOGY FOR BOTANY

COURSE : 19U1CPZOO1 ; ANIMAL DIVERSITY – NON CHORDATA

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. What is Coelom?
2. What is clitellum ?
3. What is a podomere ?
4. What are epipodites?
5. What is radula?
6. What are tube feet?
7. What is frustule?
8. Describe polymorphism ? (1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Explain Arthropodan afinities of Peripatus.
10. Describe sexual dimorphism in prawn.
11. Describe Perna
12. Give brief account on different respiratory systems in echinodermata.
13. Describe Balanoglossus.
14. Describe the unique cell wall of Bacillariophyta.
15. What are alveoli? Mention the significance.
16. Write notes on liver fluke. (2 x 6 = 12)

PART C

Answer any 4 (4 marks each)

17. What is symmetry? Explain different types of symmetry found in animals.
18. Describe Polychaeta and Oligochaeta
19. Describe thoracic appendages in prawn?
20. Describe Scaphopoda and Cephalopoda
21. Write note on Holothuroids and asteroids.
22. Write the morphology of Aurelia with diagram. (4 x 4 = 16)

PART D

Answer any 2 (12 marks each)

23. Give an account on classification and salient features of Arthropoda.
24. Give an account on the salient features and classification of mollusca.
25. Explain salient features of Echinodermata and write a note on the different classes.
26. Name different phylas coming under Kingdom Protista with examples. (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION
SEMESTER 1 : COMPLEMENTARY ZOOLOGY FOR BOTANY
COURSE: 23U3CRZOO03 – ANIMAL DIVERSITY- CHORDATA

Time: Three Hours Max Marks: 60

PART A (Answer all questions)

1. What is the name of the vertebrate division in which animals possess true jaws?
2. Which of the below given group is not included in the superclass tetrapoda?
3. What is the scientific name of river lamprey?
4. In which class of fishes Latimeria is included?
5. What is an axial skeleton?
6. What is Pyloric sphincter?
7. Order Tubulidentata includes the animal called.
8. What is the diaphragm? (1x8 = 8 marks)

PART B (Answer any 6)

9. What is the function of pharyngeal clefts in chordates?
10. What are the names of classes coming under the superclass Tetrapoda?
11. What is the peculiar mode of feeding in Petromyzon?
12. What is Cephalaspis?
13. Enumerate the salient features of order squamata.
14. Enumerate the salient features of subclass diapsida
15. What are the modifications in the male Echidna?
16. Differentiate the pleural and pericardial cavities (2x6=12 marks)

PART C (Answer any 4)

17. Describe the formation of gill slits and their modifications and functions in chordates.
18. Describe the body structure and nutrition in Petromyzon and its larva. How the adult and larva is different in feeding structure?
19. Discuss the morphology of an animal that belongs to the agnathan class Ostracodermi. Enlist the salient features of the class Ostracodermi.
20. Categorise the vertebrae of frog in to different type with their specialities.
21. Outline the classification of aves along with salient features.
22. Prototheria are regarded as unfinished mammals. Explain. (4x4=16 marks)

PART D (Answer any 2)

23. Explain the outline classification of phylum Chordata by giving description of salient features of each subphylum and divisions
24. Discuss on the differences between poisonous and non-poisonous snakes and also elaborate on any four poisonous snakes in India.
25. Simplify and draw the arterial system of frog with a neat diagram.
26. Elaborate on the modifications of various structures in aquatic mammals. (2x12=24 marks)

B. SC. DEGREE END SEMESTER EXAMINATION

SEMESTER – 3: ZOOLOGY (COMPLEMENTARY COURSE)

COURSE: 23U3CPZOO03, HUMAN PHYSIOLOGY AND IMMUNOLOGY

Time: Three Hours Max. Marks: 60

PART A

Answer all of the following.

1. What is hypoxia?
2. What is all or none law?
3. Define rigormortis?
4. What is BCG?
5. Write short notes on dialysis.
6. Define hapten.
7. Write short notes on EEG.
8. Write short notes on VDRL test. (1 x 8 = 8)

PART B

Answer any six of the following.

9. Comment on MHC.
10. Distinguish between active and passive immunity.
11. Write notes on Islets of Langerhans.
12. Give a brief account on vitamin deficiency.
13. Write notes on neurotransmitters.
14. Explain briefly the hormonal control of renal function.
15. Describe briefly the types of muscles.
16. What is CO poisoning? (2 x 6 = 12)

PART C

Answer any four of the following.

17. Write notes on hormonal disorders.
18. Write notes on complement system.
19. Elaborate hybridoma technology.
20. Define synapse. Add notes on synaptic transmission of impulse.
21. Give an account of the composition of blood
22. Explain the transport of carbon dioxide (4 x 4 = 16)

PART D

Answer any two of the following.

23. Give an account of structure and various classes of Immunoglobins.
24. Describe the ultra-structure of a striated muscle. Add note on the mechanism of muscle contraction.
25. Describe the mechanism of blood clotting.
26. Explain the process of urine formation. (12 x 2 = 24)

B. Sc. DEGREE END SEMESTER EXAMINATION
SEMESTER – 4: BOTANY (COMPLEMENTARY))
COURSE: 23U4CPZOO04: APPLIED ZOOLOGY

Time: Three Hours Max. Marks: 60

PART A

Answer all questions. Each questions carry 1 mark

1. Name 2 common species of honey bee.
2. Define vermicomposting.
3. What is sericulture?
4. Name any two diseases of fishes.
5. What is pond culture?
6. Soil structure is greatly influenced by which two major activities of earthworms?
7. How is a cocoon formed in sericulture?
8. What is bee pasturage? (1 x 8 = 8)

PART B

Answer any Six questions. Each questions carry 2 marks

9. Write note on Tilapia.
10. Comment on the properties of silk.
11. Write a note on reproduction in earthworms.
12. What is a silkworm? Mention the stages of development.
13. Write a note on 'Bee dance'
14. What are the criteria for keeping a fish as ornamental fish?
15. Mention the different methods for mussels farming.
16. What is vermiwash? (2 x 6 = 12)

PART C

Answer any Four questions. Each questions carry 4 marks

17. Write note on biological filter and aeration.
18. Write a note on silkworm diseases.
19. Write an account on rearing of worms in sericulture.
20. Describe the uses of beeswax.
21. Briefly describe the benefits of vermicomposting.
22. What are the adaptations and role of worker in a honey-bee colony? (4 x 4 = 16)

PART D

Answer any Two questions. Each questions carry 12 marks

23. Write an account on the life cycle of silkworm.
24. Give an account on Organization of honeybee colony.
25. Describe pearl formation
26. Describe the setting up of an aquarium and its management (12 x 2 = 24)